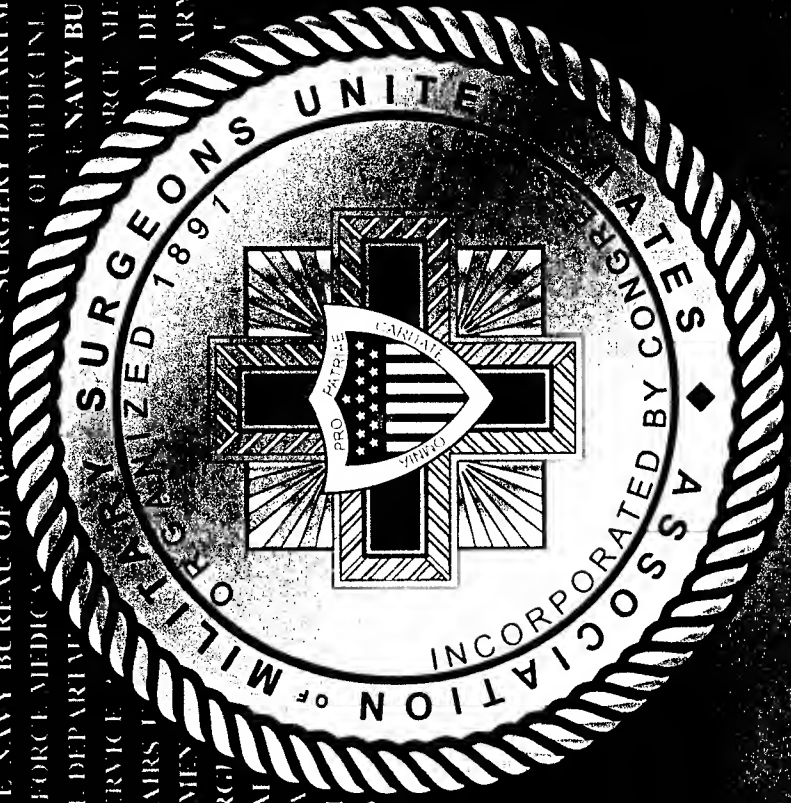


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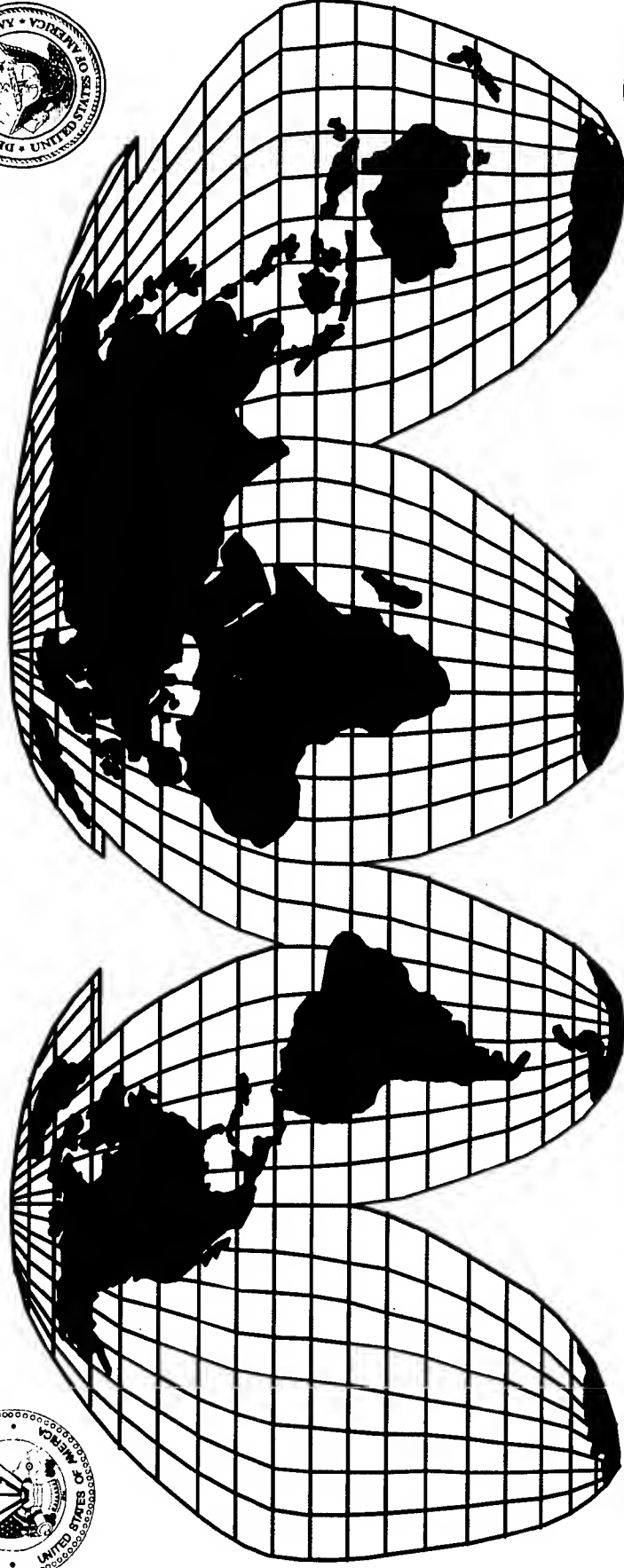
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Atlas of Injuries in the U.S. Armed Forces

Atlas of Injuries in the United States Armed Forces



A Report by the DOD Injury Surveillance and Prevention Work Group
for the Assistant Deputy Under Secretary of Defense for Safety and Occupational Health

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Foreword

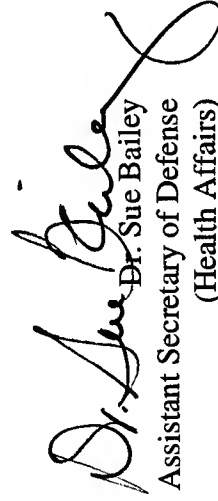
Injuries are the leading health problem impacting on U.S. military force readiness today. In fact, since World War II, nonbattle injuries and disease have caused more losses than combat casualties. However, many of the injuries, in particular, are preventable, and this atlas takes a major step toward their identification and elimination.

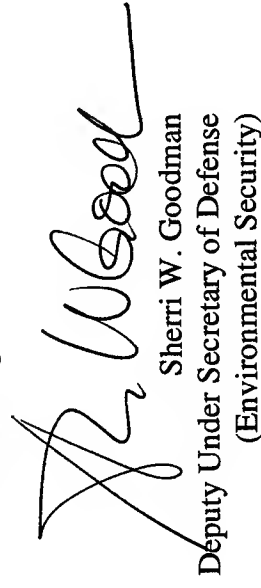
The first requisite of prevention is knowledge of the existence and size of the problem. The Department of Defense Injury Surveillance and Prevention Work Group was formed to (1) determine the magnitude of the injury problem in each service—Army, Navy, Marine Corps, and Air Force and (2) identify data sources that could be used to track and reduce the occurrence of injuries. This atlas graphically shows:

- Injuries are the leading cause of death, disabilities, hospitalizations, and outpatient visits in the military services, relative to other causes of morbidity and mortality.
- Sports, falls, training-related injuries, and motor vehicle accidents are the leading causes of injury-related morbidity.
- Unintentional injuries (accidents/mishaps), in particular motor vehicle crashes, are the leading cause of death for all services.

The tremendous potential value of existing casualty, safety, medical, personnel, and other databases for injury and disease surveillance is clearly illustrated. Information provided in this atlas can be used to prioritize and target prevention programs and research. The tools for prevention are available; successful reduction of the injury problem will depend upon the commitment of military leaders.

Prevention of injuries requires partnerships. Safety and medical personnel provide support but you, the commanders and policy makers, are the ones with the ultimate power to prevent injuries. Together we can better protect the men and women who serve our country.


Dr. Sue Bailey
Assistant Secretary of Defense
(Health Affairs)


Sherri W. Goodman
Deputy Under Secretary of Defense
(Environmental Security)

Preface

The DoD Injury Surveillance and Prevention Work Group, chartered under the DoD Safety and Occupational Health Committee and Defense Environment Security Council, was tasked to:

- Determine the size of the problem of injuries in the military.
- Document rates and trends of injury fatalities, disabilities, and hospitalizations.
- Identify information sources with potential for use in conducting injury surveillance and prevention programs.

This *Atlas of Injuries in the U.S. Armed Forces* is the result of their work.

Information provided here was collected from DoD, Army, Navy, Marine Corps, and Air Force databases that document the occurrence of injuries in military personnel. The data presented in this atlas are intended to serve several distinct purposes:

- Show the full significance of the problem of injuries for the military services.
- Demonstrate the value of existing databases for identifying causes, tracking rates and trends, and focusing of resources for prevention and research.
- Use to modify and integrate existing information management systems and institute new systems, where necessary, to provide ongoing injury surveillance. This will supply commanders with the knowledge necessary to reduce injuries and protect their operating forces in all deployment modes.

This atlas required the contributions of many safety and health professionals who served as members of the work group, as well as members of outside agencies who contributed valuable information. The DoD is forever indebted to the work of COL Bruce Jones, U.S. Army, chair of the work group, who "pulled it all together."



George W. Siebert, CIH, RS
Assistant Deputy Under Secretary
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Commentary: A Military Perspective

Major General Patrick D. Sculley, DC, Deputy Surgeon General, U.S. Army

Completed at the dawn of the 21st century, the *Atlas of Injuries in the U.S. Armed Forces* lays the foundation for a revitalized era of successful military injury prevention and control. This atlas will become the reference point for future generations of injury control professionals. Military men and women, their families, and the general public owe a debt of gratitude to all who contributed to this atlas.

The Department of Defense (DoD) Injury Surveillance and Prevention Work Group was chartered under the DoD Safety and Occupational Health Committee and Defense Environment Security Council on 28 September 1992, and began its work under the fine leadership of COL Bruce H. Jones, MC, shortly thereafter. Experts from throughout DoD were drawn together to perform the important work of defining the magnitude of injuries for the military services and examine and evaluate the many comprehensive though disparate sources of data managed by various DoD agencies. Dozens of individuals and organizations contributed to the process providing data and knowledge to the work group. The atlas is the final product of this work group.

This atlas not only demonstrates the appalling toll that injuries exact across the broad spectrum of severity, but it also identifies some remarkably successful programs to reduce this burden on the Armed Forces. Aviation safety is an area where the services have had an organized program and adequate resources applied to injury prevention for decades. The dramatic reductions in injury and accident rates related to aviation operations is the best reassurance we can find that our efforts will be rewarded.

While the atlas emphasizes injuries as a major problem for the military, this does not imply that the services are doing a poor job at injury prevention. Indeed, injuries are also the leading cause of morbidity and mortality for nonmilitary populations of similar demographic composition. In most cases, death, disability, hospitalization, and lost work time injury rates in the otherwise young healthy population serving in the military are lower than in comparable civilian populations. This is true despite the uniquely hazardous nature of military service. Nonetheless, the trust the populace places on military leaders—to manage the threat of enemy actions while preserving the well being of America's young men and women—requires more than routine or passive attention to this huge problem.

When the work group began this endeavor, the epidemic of injuries in the military was not widely appreciated, nor was the incredible volume of pertinent data available from various DoD sources. That will never be true again. Most of the DoD agencies surveyed for this report are not concerned with injuries or injury prevention per se, but collected information to serve other mission requirements. For example, the casualty center data are gathered for the most part to fulfill the mission of next-of-kin notification for all service members who die while on active duty, to ensure the timely payment of benefits, and to arrange for proper burial. However, data on these events also include information on the manner of death, which is very useful for prevention purposes. Similarly, the disability agencies are tasked with the tracking of physical disability evaluations and discharges from service for administrative purposes, not to support surveillance and research into the causes of disability in the military. Despite the administrative focus of these data collection systems, they represent an especially rich source of data addressing the spectrum of morbidity and mortality among service members.

The work group encountered many challenges in assembling these data. There was generally no standardization of data systems across the services. When the initial data requests were made only a few years ago, the information technology we already take for granted seemed more like "pie in the sky" than reality. As we approach the year 2000, this atlas will undoubtedly make its way onto at least one worldwide web site. There it will be instantly available to anyone with just a few clicks of a mouse. We have indeed come a long way in a short time!

Injuries are not random events; they are the predictable result of a complex set of risk factors, many of which can and should be controlled. Reducing injuries may not appear easy, but neither did it appear easy several decades ago when rates were substantially higher. We need to abandon our fatalistic attitudes that injuries are accidental and exploit the extraordinary opportunity to learn, cooperate, and capitalize on the knowledge and technology only recently made available. The DoD Injury Surveillance and Prevention Work Group has provided us not only the momentum but also the blueprint for success. They have convincingly demonstrated that injuries, not illnesses, are the biggest threats to the health and well being of military persons. Despite this, a relatively small amount of resources is devoted to the prevention, surveillance and research of injuries in the military, especially when compared to that devoted to illness prevention.

We need to act swiftly and decisively to exploit our recent progress in injury control. Future success in the prevention of injuries requires a thoughtful and organized plan—such as the one presented herein. The benefits of these efforts will be measured not only in cost savings but in more efficient operations, increased mission effectiveness, and less pain and suffering for the military service members under our care and trust.

Dedicated men and women serving in the Army, Navy, Marine Corps, and Air Force have placed themselves in harm's way to preserve our nation and the quality of our lives. We owe them nothing less than our absolute best effort to ensure that they can perform their jobs as safely as possible. The method to reach this goal is described here; we need to make it a reality. The details included in the final chapter of this atlas "Conclusions and Recommendations of the DoD Injury Surveillance and Prevention Work Group" provide us with all we need to get started.

Commentary: A Civilian Perspective

Andrew L. Dannenberg, MD, MPH, Epidemiology Program Office, Centers for Disease Control and Prevention¹

The publication of the *Atlas of Injuries in the U.S. Armed Forces* represents a milestone in recognizing the impact of injuries in the military. The atlas clearly documents injury as the military's leading cause of nonbattlefield deaths and as a major cause of morbidity, which take an enormous toll on the human and financial resources of the Armed Forces. With this information and the knowledge of injury interventions developed in recent years, the military now has an extraordinary opportunity to increase its efforts to reduce the incidence of injuries among service members.

Data in the atlas will be especially useful in setting priorities for injury prevention. The atlas demonstrates how existing data systems can be used for surveillance and research to identify leading injury problems and monitor injury trends. Similar to current national systems that identify emerging infectious diseases, surveillance and research databases described in this atlas can help identify emerging trends in injuries as new technologies, training, or activities are introduced in the military. For example, in the civilian world, injuries associated with all terrain vehicles and personal watercraft have been monitored using data from the Consumer Product Safety Commission and other sources. Effective interventions to reduce such recreational injuries have been and are being developed in response to such surveillance data. Available military data provide similar opportunities for responsive prevention activities.

Surveillance data should also be used to help evaluate the impact of injury interventions. For example, motor vehicle-related injuries are declining but are still the leading causes of death and hospitalization in the military. Evaluation of appropriate data could determine whether increased seat belt use or motorcycle helmet use would be likely to result in further declines in motor vehicle-related injury rates. Furthermore, injury data could be used to estimate whether implementing changes in alcohol policies or safety features of government fleet vehicles used by military personnel would promote further reductions in motor vehicle-related injury morbidity and mortality.

This atlas complements the efforts of the Armed Forces Epidemiological Board (AFEB) Injury Prevention and Control Work Group, which evaluated the availability and potential uses of data on injuries in the military. The same Department of Defense Injury Surveillance and Prevention Work Group that produced this atlas provided data for the AFEB work group. The findings and prevention recommendations of the AFEB work group will be published in a forthcoming special supplement on injuries in the military in the *American Journal of Preventive Medicine* (in press). This atlas focuses on the details of injury data evaluated by the AFEB from each of the available sources and illustrates the potential power of integrating these databases for optimal surveillance and prevention.

The data in this atlas primarily cover the 15-year period between 1980-1994 and define important trends. These data should, however, be routinely updated to fulfill the ongoing monitoring and evaluation functions mentioned above. While most of the individual databases used in this atlas are kept current, with some additional work automated links could be built between the various database systems so that updating an integrated database occurs routinely using data from many sources as they are collected. Such improvements could achieve substantial benefits for a relatively modest investment of additional resources. Another desirable step would be to reformat the data to allow simple queries, perhaps directly over the Internet, with security protection as necessary. Improved access to locally relevant integrated databases would assist DoD policy makers, commanders, and others in selecting appropriate interventions to prevent injuries.

Of the many sources of injury data in this atlas, the data on injury hospitalizations are probably the most useful. As documented in the injury pyramid, hospitalized injuries are much more common than fatal injuries and are more expensive, both in cost of care and in their impact on readiness. In both military and civilian data, the use of external cause of injury codes (E-codes) to document the cause of hospitalized injuries is critical to identify the potentially modifiable circumstances that lead to injuries. Compatibility of military with civilian cause codes would allow useful comparisons in areas of common concern (e.g., motor vehicle crashes, falls, and sports injuries).

In Chapter 9, the authors discuss the five-step public health approach to injury control²: First, determine the existence and magnitude of the problem. Second, identify the causes of and risk factors for the problem. Third, determine interventions to prevent the problem. Fourth, implement prevention strategies and programs. Fifth, monitor and evaluate the effectiveness of prevention efforts. These steps have been used effectively to address numerous types of injuries in the civilian world. Recognizing the success of this approach, the authors applied the same steps to the military setting.

The military data presented in this atlas are particularly valuable because, unlike many civilian injury databases, they have population-based denominators and can be used to calculate meaningful injury rates. The major categories of unintentional and intentional injuries seen in the military also represent significant problems for comparable civilian populations. Interventions tested and validated in the military may thus prove equally useful in civilian settings. Thus, this atlas should prove useful to both military and civilian injury control practitioners for answering important questions and for facilitating interactions between experts in the civilian and military communities.

For many years, Professor Susan Baker's classic text, *The Injury Fact Book*,³ has served the civilian community as a reliable source of injury data. This DoD atlas follows the model of the Centers for Disease Control and Prevention *U.S. Atlas of Injury*.⁴ *The Atlas of Injuries in the U.S. Armed Forces* should prove equally valuable for the military community. Beginning with these data, increased efforts in surveillance, data integration, research, and intervention implementation will pay substantial dividends in reducing injuries as a cause of morbidity and mortality in military and civilian communities.

¹ Member of the Armed Forces Epidemiological Board Injury Prevention and Control Work Group.

² Sleet DA and Rosenberg ML. Injury Control. In Scutchfield FD and Keck CW (eds). *Principles of Public Health Practice*. Albany, Delmar Publishers, 1997.

³ Baker SP, O'Neill B, Ginsburg MJ, and Li G. *The Injury Fact Book*, 2nd edition. New York: Oxford University Press, 1992.

⁴ Annest JL, Kirk ML, Houston B, Dansbury L, and Enrich SS. *Injury Mortality Atlas of the United States, 1986-1994*. Atlanta, GA: U.S. Dept. Health and Human Services, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, April 1997.

Introduction

An *injury* is defined as any intentional or unintentional damage to the body resulting from acute or chronic exposure to mechanical, thermal, electrical, or chemical energy or from the absence of such essentials as heat or oxygen.* In the past 20 years, injuries in the Armed Forces have been responsible for more deaths, disabilities, hospitalizations, and outpatient visits than any other cause:

- Deaths due to injuries were responsible for 75% of military personnel deaths from CY 1980-1993: 50% of all deaths were due to unintentional injuries, primarily caused by motor vehicles, and another 25% were caused by intentional injuries (suicides, homicides, and hostile actions).
- Disabilities due to musculoskeletal (orthopedic) conditions were the leading cause of disabilities for all military services in FY 1994 and 1995. During just one month, December 1994, injuries accounted for nearly half of all disabilities compensated by the Veterans Administration and the resulting compensation costs of \$347 million.
- Hospitalizations due to injuries and injury-related musculoskeletal disorders were the leading cause of hospitalization for the Army, Navy, and Marine Corps, and the second leading cause of hospitalization for the Air Force in 1994. During Operations Desert Shield and Storm, nonbattle injuries were the leading cause of hospitalization for Army personnel.
- Outpatient visits due to injuries are generally the result of injuries and musculoskeletal disorders associated with physical training and vigorous operational activities. These injuries have a significant impact on readiness. A fracture can account for over 100 lost duty days, and a simple sprain can result in several weeks of limited duty; either would restrict deployability.

* Adapted from the National Committee for Injury Prevention and Control. "Injury Prevention, Meeting the Challenge." *American Journal of Preventive Medicine* vol 5, no. 6, 1989.

Injuries are the single most significant medical impediment to readiness of the military. Not only do injuries impact the strength and ability of our Armed Forces to effectively respond to their mission, they levy tremendous annual costs in the hundreds of millions of dollars against the operating budgets of all the services.

Faced with the knowledge that injuries are the leading health problem of today's military services, and looking for an effective means of dealing with this problem, the DoD Injury Surveillance and Prevention Work Group was chartered under the DoD Safety and Occupational Health Committee and Defense Environment Security Council on 28 September 1992. The work group convened for the first time on 1 December 1992 and reviewed its charter:

Technical and policy advisor for all aspects of injury surveillance and prevention. Functional area experts concerning injury surveillance and prevention, including creation of a database for tracking injuries (types, costs, time lost, etc.), and coordinating with the DoD Subcommittee on Corporate Information Management (CIM) for Occupational Health and Safety Management Information Systems.

At this initial meeting, the work group discussed its primary purpose—to identify and inventory the databases maintained by the military services that possess injury surveillance potential—and developed the objectives that would guide them through the next 6 years:

- Identify existing casualty, safety, medical, and personnel databases across all services.
- Collect and summarize data from these databases.
- Assess the value of these databases to injury surveillance.
- Document the magnitude of the injury problem—from deaths to outpatient visits—for all services.
- Present these data in a format that would demonstrate each database's utility as an injury and prevention surveillance tool.
- Make recommendations for future surveillance and prevention of injuries.

The *Atlas of Injuries in the U.S. Armed Forces* resulted from the work group's collaborative efforts to achieve these goals. This is a resource document that illuminates the rich military data sources and research organizations that can contribute to future injury prevention. Most of the databases presented in the atlas were designed for administrative purposes, not research or surveillance. It is the intent of this document to use those databases to:

- Document the magnitude of the injury problem for each service.
- Show general trends of injuries and other medical conditions for each service.
- Place injuries in context with all medical problems.
- Show the potential use of administrative databases for surveillance, research, and planning of prevention strategies.

This report provides a foundation and impetus for decision and policy makers and commanders to join safety and research experts in a concerted effort to prevent injuries. A large return on the investment of surveillance and research resources can be expected through such a collaborative preventive effort.



Colonel Bruce H. Jones, MC, U.S. Army
Chair, DoD Injury Surveillance and
Prevention Work Group

Executive Summary

In the past 20 years, injuries in the Armed Forces have been responsible for more deaths, disabilities, hospitalizations, and outpatient visits than any other cause. Injuries pose the single most significant medical impediment to readiness in the military. Not only do injuries impact the strength and ability of our Armed Forces to effectively respond to their mission, they levy staggering annual costs in the hundreds of millions of dollars against the operating budgets of all the services.

The DoD Injury Surveillance and Prevention Work Group's *Atlas of Injuries in the U.S. Armed Forces*:

- Documents the magnitude of the injury problem for each service.
- Shows general trends of injuries and other medical conditions for each service.
- Places injuries in context with all medical problems.
- Shows the potential use of administrative databases for surveillance, research, and/or planning of prevention strategies.

The work group concluded:

- Injuries are the leading cause of death.
- Deaths have decreased substantially from FY 1980-1995 primarily due to decreases in unintentional injury (accidental) deaths, but a great need for continued prevention efforts exists.
- Musculoskeletal (orthopedic) conditions are the leading cause of disability.
- As the leading cause of disability, musculoskeletal (orthopedic) conditions account for a large proportion of DoD disability costs.
- Musculoskeletal (orthopedic) conditions are the leading cause of Veterans Administration disability payments.
- Injuries and musculoskeletal sequelae are the leading causes of hospitalization.
- Injuries are a major cause of morbidity associated with vigorous physical training.
- Vehicle accidents remain the leading specific cause of death, despite successful prevention efforts.
- Athletic or sports injuries, falls, and physical training are significant contributors to the occurrence of nonfatal injuries.
- Surveillance systems, research, and safety programs represent necessary elements of the injury prevention process.
- Surveillance and research data have been used to identify modifiable causes of injury and to prevent injuries.


Based on the above conclusions, the work group's recommendations for preventing and controlling injuries in the military services are:

- Use surveillance to routinely identify and prioritize prevention and research targets.
- Provide surveillance and research information to those who can act.
- Mobilize support of commanders and policy makers.
- Ensure adequate injury research to support prevention programs.
- Enhance injury evaluation research support.
- Routinely monitor and evaluate efficacy of prevention programs.
- Use multiple data sources to track rates and trends of injuries to monitor the effectiveness of interventions and prevention programs.

These recommendations may be accomplished by a number of specific actions such as:

- Enhancing the Defense Medical Surveillance System capabilities to routinely conduct injury and other surveillance.
- Establishing a DoD Injury Advisory Council including surveillance, research, safety, and other key representatives from each of the services that meets routinely to review surveillance and current research data and evaluate progress toward prevention goals.
- Creating a DoD Injury Research Center to address both the cross-cutting injury problems of the services and service specific problems.

The atlas is a resource document that provides a foundation and impetus for decision and policy makers and commanders to prevent injuries. It also serves as a tool for focusing more rigorous future research on injury prevention. A large return on the investment of surveillance and research resources can be achieved through a concerted effort to prevent injuries.


Raymond J. Fatz
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CHAPTER 1

PROCESS OF INJURY DATA ACQUISITION AND REPORTING

Michelle L. Canham, MPH, Judith B. Schmitt, and Bruce H. Jones, MD, MPH

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Section I. The Work Group

1-1. Introduction

Objectives. The DoD Injury Surveillance and Prevention Work Group convened for the first time on 1 December 1992. Chaired by Colonel Bruce H. Jones, work group members included representatives from the Office of the Assistant Secretary of Defense and all four services: Army, Navy, Marine Corps, and Air Force. At this initial meeting, the work group reviewed its injury prevention charter and discussed its mission, which included the following:

- Identify existing casualty, safety, medical, and personnel databases across all services.
- Collect and summarize data from these databases.
- Assess the value of these databases to injury surveillance.
- Document the magnitude of the injury problem—from deaths to outpatient visits—for all services.
- Present these data in a format that would demonstrate each database's utility as an injury and prevention surveillance tool.
- Make recommendations for future surveillance and prevention of injuries.

The *Atlas of Injuries in the U.S. Armed Forces* is the result of the work group's efforts to satisfy these objectives.

Membership. At any one time, the work group consisted of 8 to 12 active members. **Table 1-1** lists the participating members over time. Members were selected to represent the safety and medical communities of all the military departments.

Table 1-1. DoD Injury Surveillance and Prevention Work Group Members

Members (in alphabetical order)	Agency/Affiliation at Time of Work Group Service
LTC Paul J. Amoroso, secretary	U.S. Army Research Institute of Environmental Medicine
Anita L. Dudley	Army Safety Office, Office of the Chief of Staff
COL Eric Evenson	Office of The Army Surgeon General
COL John W. Gardner	Uniformed Services University of Health Sciences
CDR James Helmkamp	National Institute for Occupational Safety and Health
LCDR Gregory Hempen	Naval Safety Center
COL Bruce H. Jones, chair	U.S. Army Center for Health Promotion and Preventive Medicine
Mr. Albert Lillibridge	Safety Office, Headquarters, U.S. Marine Corps
Mr. Robert Parli	Safety Office, Headquarters, U.S. Air Force
LtCol Chip Patterson	Office of the Assistant Secretary of Defense for Health Affairs
LtCol John F. Seibert	Office of the Deputy Under Secretary of Defense (Environmental Security), Safety & Occupational Health Policy
CAPT Ken A. St.Andre	Office of the Assistant Secretary of Defense for Health Affairs
COL H.E. Wolfe	Office of the Assistant Secretary of the Army for Installations, Logistics, and Environment
LtCol Hank Woodcock	Office of The Surgeon General, Headquarters, U.S. Air Force
Mr. William H. Wortley	Army Safety Office, Office of the Chief of Staff

1-2. Meetings

The work group met nine times between December 1992 and September 1995 to acquire information and data, and on two occasions in September 1996 and March 1997 to prepare their report. Table 1-2 displays the main agenda items of the 11 work group meetings that took place over this 6-year period.

Table 1-2. DoD Injury Surveillance and Prevention Work Group Meetings—Key Agenda Items

Meeting	Date	Agenda Items
1	1 Dec 92	<ul style="list-style-type: none"> • Work group formation and mission. • Key DoD Health 2000 target injury objectives as context for work group activities. • Objectives and priorities for information acquisitions on DoD military and civilian populations, including frequency and rates of death, hospitalization, disability, and restricted duty. • Sources of information and a strategy for data acquisition.
2	14 Apr 93	<ul style="list-style-type: none"> • National injury trends based on Centers for Disease Control and Prevention data and a comparison with DoD trends. • Army accident and injury rates. • Priorities for DoD Promoting Health 2000 and National Healthy People 2000 objectives as background for work group activities.
3	30 Jun 93	<ul style="list-style-type: none"> • Army, Navy, and Air Force briefings on service safety center/agency missions and databases.
4	8 Dec 93	<ul style="list-style-type: none"> • Army, Navy, and Air Force briefings on service hospitalization databases. • Special Navy report on frequency, costs, work site safety ratings, and injuries among civilian employees.

Table 1-2.—Continued

Meeting	Date	Agenda Items
5	13 Jul 94	<ul style="list-style-type: none"> • Defense Manpower Data Center personnel/demographic databases. • Army Physical Disability Agency. • Navy and Marine Corps Physical Evaluation Board. • Navy Medical Information Management Center. • Air Force Physical Disability Division.
6	16 Dec 94	<ul style="list-style-type: none"> • Format and contents of the atlas. • Data requirements for the atlas sections. • Atlas time line.
7	15 May 95	<ul style="list-style-type: none"> • Other injury prevention and surveillance activities in DoD. • Veterans Administration data. • Operation Desert Storm data.
8	8 Aug 95	<ul style="list-style-type: none"> • Service Casualty Office databases. • Army Medical Evaluation Board Surveillance Project. • Defense Veterans Head Injury Program.
9	6 Sep 95	<ul style="list-style-type: none"> • Navy and Marine Corps outpatient and deployment surveillance experiences and data. • Injuries among Marine Corps recruits. • Navy Safety Center overview and mishap trends. • Marine Corps Safety Office data.
10	23 Sep 96	<ul style="list-style-type: none"> • Draft report, <i>Atlas of Injuries in the U.S. Armed Forces</i>. • Collection of missing data.
11	26 Mar 97	<ul style="list-style-type: none"> • Atlas conclusions and recommendations.

1-3. Data Acquisition

The Atlas of Injuries in the U.S. Armed Forces is the product of data collected from three sources:

- Presentations to the work group members (Table 1-3).
- Responses to the work group questionnaire (Table 1-4).
- Responses to the work group's specific written requests (Table 1-5).

Presentations to the Work Group Members. To acquire injury data for the atlas, various agency representatives were invited to brief the work group members during their meetings. **Table 1-3** displays the responding agencies by service and presentation topic.

Table 1-3. Presentations to the DoD Injury Surveillance and Prevention Work Group

Service	Agency Presentations				
	Deaths	Accidents/Mishaps	Disabilities	Hospitalizations	Personnel and Demographics
DoD	<ul style="list-style-type: none"> • DIOR Report on Worldwide Casualties 	—	—	<ul style="list-style-type: none"> • Office of the Assistant Secretary of Defense 	<ul style="list-style-type: none"> • Defense Manpower Data Center
Army	—	<ul style="list-style-type: none"> • Army Safety Center 	<ul style="list-style-type: none"> • Army Physical Disability Agency • Patient Administration Systems and Biostatistics Activity 	<ul style="list-style-type: none"> • Patient Administration Systems and Biostatistics Activity 	—
Navy	<ul style="list-style-type: none"> • Naval Medical Information Management Center 	<ul style="list-style-type: none"> • Naval Safety Center 	<ul style="list-style-type: none"> • Navy and Marine Corps Physical Evaluation Board • Naval Medical Information Management Center 	<ul style="list-style-type: none"> • Naval Medical Information Management Center • Naval Health Research Center 	—
Marine Corps	<ul style="list-style-type: none"> • Marine Corps Casualty Office • Naval Medical Information Management Center 	<ul style="list-style-type: none"> • Safety Office, Headquarters, Marine Corps 	<ul style="list-style-type: none"> • Navy and Marine Corps Physical Evaluation Board 	<ul style="list-style-type: none"> • Naval Medical Information Management Center 	—
Air Force	—	<ul style="list-style-type: none"> • Air Force Safety Agency/Center 	<ul style="list-style-type: none"> • Air Force Physical Disability Division 	<ul style="list-style-type: none"> • Air Force Medical Support Agency 	—

Responses to the Work Group Questionnaire. In June 1995, the work group mailed a questionnaire to key agencies to collect information on the nature and contents of databases with the potential for routine or episodic injury surveillance. A copy of the questionnaire is provided in the appendix at the end of this chapter. Specifically, the questionnaire solicited information on:

- The mission of the organization maintaining the database and the major purposes for the database's current utilization.
- The contents and codes of the database.
- Any routine reports generated from the database that might be useful to injury surveillance and prevention efforts.

In addition to completing the questionnaire, each agency was asked to provide the following data:

- Population (Army, Navy, Marine Corps, Air Force, Reserve, National Guard).
- Demographics (gender, age, race, etc.).
- Types of injury (diagnosis/disability categories, etc.).
- External causes of injury or categories of mishap.
- Medical and other associated costs of injuries, disease, or accidents/mishaps.

Table 1-4 displays the agencies that responded to the questionnaire.

Table 1-4. Agencies Responding to the DoD Injury Surveillance and Prevention Work Group Questionnaire

Service	Atlas Chapters			
	Chapter 2: Deaths Due to Injuries: Casualty Office Data	Chapter 3: Fatal and Nonfatal Accidents/Mishaps: Safety Center Data	Chapter 4: Disabilities Related to the Musculoskeletal System: Physical Evaluation Board Data	Chapter 5: Hospitalizations Due to Injury: Inpatient Medical Records Data
DoD	—	—	—	• Patient Administration Systems and Biostatistics Activity
Army	• Army Casualty Office	• Army Safety Center	• Army Physical Disability Agency	—
Navy	• Bureau of Naval Personnel/ Navy Casualty Office	• Naval Safety Center	• Physical Evaluation Board, Naval Council of Personnel Boards	• Naval Health Research Center • Naval Medical Information Management Center
Marine Corps	• Headquarters Marine Corps Casualty Section, Personnel Affairs Branch	• Safety Office, Headquarters, Marine Corps	*	†
Air Force	• Headquarters Air Force Personnel Center	• Air Force Safety Agency/ Center	• Air Force Personnel Center, Disability Division	• Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force.

* Navy and Marine Corps have a combined disability board.

† Navy Medical Departments provide health care and maintain hospitalization records on Marine Corps personnel.

Responses to the Work Group's Written Requests. Data that were not obtained by presentations to the work group, or from the work group questionnaire, were specifically requested from the appropriate agency. **Table 1-5** provides a complete list of all of the data sources presented in the atlas.

Table 1-5. Atlas Data Sources by Service

	Army	Navy	Marine Corps	Air Force
Deaths	<ul style="list-style-type: none"> • DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 1979-Dec 1995. • Armed Forces Epidemiological Board, <i>Injuries in the Military: A Hidden Epidemic</i>, 1996. • Army Casualty Information Processing Center. 	<ul style="list-style-type: none"> • DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 1979-Dec 1995. 	<ul style="list-style-type: none"> • DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 1979-Dec 1995. • Armed Forces Epidemiological Board, <i>Injuries in the Military: A Hidden Epidemic</i>, 1996. 	<ul style="list-style-type: none"> • DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 1979-Dec 1995. • Armed Forces Epidemiological Board, <i>Injuries in the Military: A Hidden Epidemic</i>, 1996.
Accidents/ Mishaps	<ul style="list-style-type: none"> • Army Safety Center, Fort Rucker, AL, 1995 and 1997, and personal communication, 1997. 	<ul style="list-style-type: none"> • Naval Safety Center, 1998. 	<ul style="list-style-type: none"> • Naval Safety Center, Norfolk, VA, 1998. • Safety Office, Headquarters, Marine Corps, Sep 1995. 	<ul style="list-style-type: none"> • Headquarters, Air Force Safety Agency, Albuquerque, NM, 1995. • U.S. Air Force Mishap Bulletin, Albuquerque, NM, 1980-1991.
Disabilities	<ul style="list-style-type: none"> • Army Physical Disability Agency, WRAMC, Forest Glen Annex, Washington, DC, February 1996. • Page, Gregory L., 1995. 	<ul style="list-style-type: none"> • Department of the Navy, Naval Council of Personnel Boards, Arlington, VA, 1995. • Naval Medical Information Management System, Medical Evaluation Board, Bethesda, MD, 1994. 	—	<ul style="list-style-type: none"> • Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.

Table 1-5.—Continued

	Army	Navy	Marine Corps	Air Force
Hospitalizations	<ul style="list-style-type: none"> • Individual Patient Data System, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, U.S. Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD, 1994 and 1996. • Armed Forces Epidemiological Board, <i>Injuries in the Military: A Hidden Epidemic</i>, 1996. 	<ul style="list-style-type: none"> • Naval Medical Information Management Center, Bethesda, MD, 1996. • Naval Health Research Center, Navy Hospital Records Database, San Diego, CA, 1993. 	<ul style="list-style-type: none"> • Naval Medical Information Management Center, Bethesda, MD, 1996. 	<ul style="list-style-type: none"> • Medical Information Systems Division, Directorate of Health Care Support, Office of The Surgeon General, U.S. Air Force, 1993.
Epidemiology and Research	<ul style="list-style-type: none"> • Amoroso, P.J., et al., 1997. • Amoroso, P.J., et al., 1998. • Bell, N.S., et al., 1996. • Bell, N.S., et al., unpublished. • Bense, C.K., & R.N. Kish, 1983. • Bricknel, M.C.M., et al., in press. • Canham, M.L., et al., 1996. • Cowan D., et al., 1988. • Cowan, D.N., et al., 1993. • Cowan, D.N. et al., 1996. • Jones, B.H., et al., 1988. • Jones, B.H., et al., 1992. • Jones, B.H., et al., 1993. • Jones, B.H., et al., 1993. • Jones, B.H., & J.J. Knapik, 1994. • Jones, B.H., 1997. • Jones, B.H., & J.J. Knapik, 1999. 	<ul style="list-style-type: none"> • Naval Health Research Center, personal communication, 1996. 	<ul style="list-style-type: none"> • Naval Health Research Center, personal communication, 1996. • Gardner L.I., et al., 1988. • Kimsey, C.D., Jr., 1993. 	<ul style="list-style-type: none"> • Snedecor, M.R., et al., 1996.

Table 1-5.—Continued

	Army	Navy	Marine Corps	Air Force
Epidemiology and Research— Continued	<ul style="list-style-type: none"> • Kowal, D.M., 1980. • Tomlinson, J.P., et al., 1987. • Total Army Injury and Health Outcomes Database, U.S. Army Research Institute of Environmental Medicine, Natick, MA, 1997. • Westphal, K.A., et al., 1995. 			
	<ul style="list-style-type: none"> • Department of Veterans Affairs, National Center for Veteran Analysis and Statistics, Veterans Administration Annual Report, Washington, DC, 1995. 			
Traumatic Brain Injuries	<ul style="list-style-type: none"> • Max, W., et al., 1991. • Ommaya, Alexander K., Paper presented to DoD Injury Surveillance and Prevention Work Group, August 1995. • Ommaya, Alexander K., et al. 1996. 			
Population Data	<ul style="list-style-type: none"> • National Mortality Profile of Active Duty Personnel in the U.S. Armed Forces, 1980-1993. Department of Health and Human Services (National Institute for Occupational Safety and Health) Publication No. 96-103. • DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 1979-Dec 1995. 			

Section II. The Work Group Report

1-4. Organization of the Report

Introductory information is presented in the beginning of the atlas in four sections:

- Foreword.
- Preface.
- Introduction.
- Chapter 1: Methodology.

Chapters 2 through 6 appear in order of severity of injury from most to least:

- Chapter 2: Deaths.
- Chapter 3: Accidents/mishaps.
- Chapter 4: Disabilities.
- Chapter 5: Hospitalizations.
- Chapter 6: Outpatient data.

Chapters 7 and 8 present data from two model databases:

- Chapter 7: Defense and Veterans Head Injury Program (DVHIP).
- Chapter 8: Total Army Injury and Health Outcomes Database (TAIHOD).

Conclusions and recommendations drawn from the data presented in chapters 2 through 8 are presented in Chapter 9.

Four appendices—Classification Codes, Glossary of Acronyms, Glossary of Terms, and References—complete the atlas.

1-5. Chapter Format

The atlas is presented in a landscape format. When figures are displayed, the explanatory text appears on even pages with the corresponding figures on odd pages. This design allows for the reading of the text while viewing the figures.

Description of the Databases. Within chapters 2 through 8, the mission, purpose, authority, and database contents* are provided for each database. For chapters 2 through 5 and 7, a table displays how the contents of each database compare to the Minimum Basic Data Set (MBDS) Requirements from the International Collaborative Effort on Injury Statistics (ICE).

Minimum Basic Data Set Requirements. The atlas:

- Includes a comparison of the MBDS recommended by ICE and the contents of each military database described in chapters 2 through 5 and 7.
- Focuses on unintentional injuries only and does not include intentional injury rates, with the exception of data on suicides and homicides in Chapter 2, and suicides in Chapter 8.

Table 1-6 displays the MBDS requirements for unintentional and intentional injuries.

* Database contents are not provided in Chapter 6.

Table 1-6. Minimum Basic Data Set Required for Unintentional and Intentional Injuries

Unintentional Injuries*		Intentional Injuries†
Intent		Intent
Age of victim		Age of victim and perpetrator
Sex of victim		Sex of victim and perpetrator
Race of victim		Race of victim and perpetrator
Residence of victim		Time and date of injury event
Date of injury event		Type of injury/body location
Place of occurrence (home, work, school, etc.)		Place of occurrence (home, work, school, etc.)
Address of place of occurrence		Address of place of occurrence
Activity when injury occurred (work, education, sports, etc.)		Circumstances or motive surrounding injury event
Mechanism of accident/event		Drugs or alcohol involved (yes/no)
Type of injury/body location		Weapon(s) involved
Outcome measurements appropriate for data source (days in hospital, cost of care, degree of disability, etc.)		Relationship of victim to perpetrator
		Outcome measurements appropriate for data source (days in hospital, degree of disability, etc.)
		Source of data

* Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994.

† Powell, K. and J. Kraus. Minimum Basic Data Set, Intentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:35-1 to 35-2, 1994.

Data Presentation. Within chapters 2 through 6, service data are presented in the following order: DoD (if applicable), Army, Navy, Marine Corps, and Air Force, followed by a section of tables that compares all of the services. Within each service section, data are presented as narrative, figures, and tables in the following order:

- Summary of data in chapter.
- Magnitude of the injury problem relative to other causes.
- Trends of the injury problem relative to other causes over time.

Summary tables displayed throughout each chapter combine data that are illustrated in two or more figures. Conclusions drawn from these figure comparisons are provided in the tables.

Database Populations. The population data presented in the atlas is defined as either military personnel or active duty personnel.

- Military personnel, as defined in DoD Instruction (DoDI) 6005.1, includes all military personnel on active duty, and Reserve or National Guard personnel on active duty or in drill status.
- Active duty personnel, as defined in DoDI 1300.18, is full-time duty in the active military services of the United States. It is a general term applied to all active military service with the active force without regard to duration or purpose.

Where possible, the work group collected data on active duty personnel only for two key reasons:

- The primary mission of the military is to sustain the health and combat readiness of U.S. fighting forces.
- The most complete and best quality medical, population, and demographic data exist for active duty personnel.

1-6. Standardization of Data Reporting

The atlas is designed to present similar data for each service in the same format so it can be easily compared.

- Tables display both frequencies and rates.
- Pie charts or bar graphs present frequency distributions (%).
- Line graphs, with supporting worksheet data tables, illustrate rates and trends over time.

Whenever possible, comparable data for the Army, Navy, Marine Corps, and Air Force are presented. However, data were often reported differently by the services or by agencies within services (e.g., non-effective rates (NERS) were reported per 1,000 personnel per day by the Army and per 100,000 personnel per day by the Air Force). In these cases, the data are presented as reported due to potential variations in how the data were tabulated by each agency.

Data Tabulation. Much of the data that were collected by the work group required additional tabulation to fit the desired format of the work group report (described in paragraph 1-5). The data were tabulated as follows:

- **Percent distributions.** The percent distribution was calculated for injuries versus other causes of morbidity and mortality by dividing the number of events in a specific category by the overall (total) number of events. For example, in 1993 there were a total of 1,245 deaths for all services combined. Of these, accidental injuries accounted for 54% (667 accidental injury deaths/1,245 total deaths); suicides accounted for 19% (240/1,245); illnesses accounted for 17% (215/1,245); homicides accounted for 7% (87/1,245); and all other causes accounted for 3% (36/1,245).
- **Rates.** Often, rates of adverse medical outcomes were calculated by the agency from which the data were requested. However, when rates were not supplied, they were calculated as cases in a year divided by the number of personnel in that year. Numerator data (cases of injuries, disease, or accidents/mishaps) were obtained from multiple sources such as casualty offices, disability agencies, and hospital record systems. Denominator data were acquired from one of two sources:
 - **Table 1-7** displays the active duty military personnel strength for FY 1980-1995 used to make the FY calculations.

Table 1-7. Active Duty Military Personnel Strength, FY 1980-1995*

Fiscal Year	Army	Navy	Marine Corps	Air Force	Total
1980	777,036	527,153	188,469	557,969	2,050,627
1981	781,419	540,219	190,620	570,302	2,082,560
1982	780,391	552,996	192,380	582,845	2,108,612
1983	779,643	557,573	194,089	592,044	2,123,349
1984	780,180	564,638	196,214	597,125	2,138,157
1985	780,787	570,705	198,025	601,515	2,151,032
1986	780,980	581,119	198,814	608,199	2,169,112
1987	780,815	586,842	199,525	607,035	2,174,217
1988	771,847	592,570	197,350	576,446	2,138,213
1989	769,741	592,652	196,956	570,880	2,130,229
1990	732,403	579,417	196,652	535,233	2,043,705
1991	710,233	570,262	194,040	510,432	1,984,967
1992	610,450	541,883	184,529	470,315	1,807,177
1993	572,423	509,950	178,379	444,351	1,705,103
1994	541,343	468,662	174,158	426,327	1,610,490
1995	508,559	434,617	174,639	400,409	1,518,224
Total	11,458,250	8,771,258	3,054,839	8,651,427	31,156,554

* Population denominator data for calculating rates for information tabulated by fiscal year.

Source: *DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95*. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

- **Table 1-8** displays the active duty military personnel strength for CY 1980-1994 used to make the CY and gender specific rate calculations.

Table 1-8. Active Duty Military Personnel Strength, CY 1980-1994*

CY	Army			Navy			Marine Corps			Air Force		
	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total
1980	697,943	69,705	767,648	490,063	35,999	526,062	180,439	6,750	187,189	494,521	61,087	555,608
1981	704,991	72,358	777,349	497,899	40,972	538,871	182,687	7,770	190,457	507,077	63,728	570,805
1982	699,719	74,462	774,181	511,997	44,390	556,387	188,532	8,630	197,162	518,679	65,039	583,718
1983	698,359	76,232	774,591	505,124	46,705	551,829	186,483	8,940	197,423	524,352	65,931	590,283
1984	699,209	77,136	776,345	507,988	47,845	555,833	188,348	9,359	197,707	527,231	66,896	594,127
1985	696,265	78,864	775,129	514,056	51,981	566,037	187,465	9,744	197,209	528,710	70,514	599,224
1986	697,215	82,814	780,029	525,406	53,405	578,811	188,247	9,832	198,079	533,349	74,236	607,585
1987	690,198	83,297	773,495	530,583	52,710	583,293	188,906	9,588	198,494	525,047	75,931	600,978
1988	676,806	83,969	760,775	523,075	54,455	577,530	185,426	9,624	195,050	498,991	75,006	573,997
1989	671,829	86,469	758,298	523,311	57,292	580,603	187,622	9,480	197,102	485,808	76,583	562,391
1990	651,778	83,789	735,567	517,070	56,970	574,040	188,619	9,305	197,924	453,482	73,341	526,823
1991	608,236	77,964	686,200	498,328	54,986	553,314	184,324	8,813	193,137	426,412	71,164	497,576
1992	523,335	72,456	595,791	470,102	54,745	524,847	174,765	8,271	183,036	387,934	66,988	454,922
1993	490,330	70,781	561,111	437,193	52,522	489,715	169,075	7,659	176,734	367,833	65,746	433,579
1994	460,433	69,009	529,442	400,659	52,367	453,026	172,643	8,176	180,819	347,726	64,797	412,523
Total	9,666,646	1,159,305	10,825,951	7,452,854	757,344	8,210,198	2,753,581	214,389	2,885,522	7,127,152	1,036,987	8,164,139

* Population denominator data for calculating rates for information tabulated by calendar year or gender.

Source: Obtained from DMDC by CDR James Helmkamp, U.S. Navy, for the *National Mortality Profile of Active Duty Personnel in the U.S. Armed Forces, 1980-1994*, a NIOSH Report (Pub 96-103).

1-7. Summary

The *Atlas of Injuries in the U.S. Armed Forces* is the result of 6 years of painstaking data collection and evaluation. This report illustrates, in over 150 figures and 100 tables, what has been believed for years: injuries are the leading health problem impacting U.S. military force readiness today. The extensive data provided in the atlas serves as the foundation for future briefings and reports addressing injury surveillance and prevention.

Appendix. DoD Injury Surveillance and Prevention Work Group Questionnaire

Work Sheet for Data Bases with Potential for Surveillance of Injuries to Active Duty and Civilian Military Personnel

Date: ____/____/____

Name of person completing work sheet: _____

Organization of person completing: _____

1. General information about data bases with surveillance capabilities or potential:

a. Name of data base: _____

b. Name of organization/agency managing data base: _____

If this organization/agency maintains more than one data base (e.g., one for active duty and one for civilian personnel), then fill out a separate form for each data base.

c. What is the primary mission of the organization (e.g., Naval Medical Information Management System, Army Safety Center, Air Force Safety Agency, Naval Physical Evaluation Board, etc.) directly responsible for maintaining this data base? Please summarize that mission: _____

d. What are the primary purposes for which the data in this data base are used (e.g. administrative tracking of cases, determining patient loads and distributions of diagnoses, medical/injury surveillance, etc.)? Please list major purposes:

1. _____

2. _____

3. _____

4. _____

5. _____

2. For what military populations are data primarily maintained in this data base? Check each of the following that are applicable:

<u>Service</u>	<u>Active Duty</u>	<u>Military Reserve</u>	<u>NG</u>	<u>Civilian</u>
Army	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Navy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Marines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air Force	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments on types of personnel for whom deaths accidents or injuries are reported to this data base:

3. What DoD and Service Specific Directives and Regulations govern collection and maintenance of the data for this data base?

List: Title Number

4. What types of accidents and injuries are required to be reported to this organization/agency? Describe briefly:

5. What forms are used to document/collect accident, injury, or death data by this agency?

List: Form Title Form Number

Please, provide examples of key forms for inclusion in the DOD Injury Work Group report.

6. Who is required to complete/fill out accident, injury or death data forms?

List: Form Title Person/s Filling Out

7. Who transcribes and enters accident, injury or death data into the computerized data base? At what locations or organization/s? Describe:

8. What personal characteristics and demographic data are maintained in the computer data base on the individuals injured or dead? Please check a "Yes" or a "No" for each of the following:

	YES	NO	Comments/Descriptions
Name:	<input type="checkbox"/>	<input type="checkbox"/>	
SSN:	<input type="checkbox"/>	<input type="checkbox"/>	
Age:	<input type="checkbox"/>	<input type="checkbox"/>	
DOB:	<input type="checkbox"/>	<input type="checkbox"/>	
Gender:	<input type="checkbox"/>	<input type="checkbox"/>	
Race:	<input type="checkbox"/>	<input type="checkbox"/>	
Rank:	<input type="checkbox"/>	<input type="checkbox"/>	
MOS/:	<input type="checkbox"/>	<input type="checkbox"/>	
Occupation			
Other:	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	

Additional comments on personal characteristics and demographic data maintained on individuals recorded in this data base: _____

9. What key information is maintained in the computer data base on the medical nature or diagnosis of the injury, disability or death and medical care received for it? Please check a "Yes" or a "No" for each of the following:

	YES	NO	Comments/Descriptions
Diagnosis/Type of Injury	<input type="checkbox"/>	<input type="checkbox"/>	
Type of Treatment	<input type="checkbox"/>	<input type="checkbox"/>	
Dates Treatment Received	<input type="checkbox"/>	<input type="checkbox"/>	
Date Admitted to Hosp	<input type="checkbox"/>	<input type="checkbox"/>	
Date Discharged Hosp	<input type="checkbox"/>	<input type="checkbox"/>	
Nature of Disability	<input type="checkbox"/>	<input type="checkbox"/>	
Degree of Disability	<input type="checkbox"/>	<input type="checkbox"/>	
Severity of Injury	<input type="checkbox"/>	<input type="checkbox"/>	
Days of Limited Duty	<input type="checkbox"/>	<input type="checkbox"/>	
Days in Hospital	<input type="checkbox"/>	<input type="checkbox"/>	
Costs of Treatment	<input type="checkbox"/>	<input type="checkbox"/>	

Other:

_____	[]	[]
_____	[]	[]

Where appropriate, for each of the above checked "yes," comment on the coding system used to enter it in the data base. If the coding system is not a widely used one, such as the International Classification of Disease (ICD-9), Veteran's Administration Schedule of Ratings of Disabilities (VASRD Codes) or the Abbreviate Severity of Injury Scale (ASIS), please provide/attach a list of the coding categories and subcategories on a separate sheet or Xerox.

Additional comments on coding of medical nature of injuries: _____

10. What key information is maintained in the computer data base on the type or category of accident or external cause of injury? Please check a "Yes" or a "No" for each of the following:

	YES	NO	Comments/Descriptions
Type/Cause of Accident/Injury	[]	[]	_____
Date of Accident/Event	[]	[]	_____
Time of Accident/Event	[]	[]	_____
On/Off Duty/Work	[]	[]	_____
Job/Activity Associated	[]	[]	_____
Equipment Involved	[]	[]	_____
Cost of Accident/Injury	[]	[]	_____
Other:			_____
_____	[]	[]	_____
_____	[]	[]	_____

Where appropriate, for the above items checked "yes," comment on/note the coding system used categorized the types accidents or external causes of injury. If the coding system is not a standard, commonly used one, such as the ICD-9 external cause codes (E-Codes) or the Standard NATO Codes (STANAG Codes) used by military hospital please provide/attach a list of code categories and subcategories on a separate labeled sheet of paper or Xerox copy.

Additional comments on data collected and maintained on the type of event or cause resulting in the reported injury: _____

11. Are data from this organization/agency's data base used to make routine reports (such as a quarterly or annual reports) on the frequency (numbers) or rates (number per unit of population per time period) of injuries, disabilities, deaths or accidents for DoD or a Military Service or other defined military population? Please check one ☐ YES, ☐ NO.

If "Yes," frequencies or rates are routinely reported, what is the name of the report and what is the periodicity of the report (i.e., quarterly, annually, etc.)?

List: <u>Name of Report</u>	<u>Periodicity</u> (How often)	<u>Comments</u>
_____	_____	_____
_____	_____	_____

If data from this source is routinely used to make reports, please provide/attach a copy of the most recent 1994 reports on injuries, disabilities, deaths or accidents.

12. Is/are there a document or documents that describe/s this data base and its contents, elements or fields?

☐ YES, ☐ NO

If "Yes," please provide copies of the data element dictionary and/or code books, etc. for this data base to the DoD Injury Work Group files.

CHAPTER 2

DEATHS DUE TO INJURIES: CASUALTY OFFICE DATA

James Helmkamp, PhD, FACE, John W. Gardner, MD, DrPH, and Paul J. Amoroso, MD, MPH

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Section I. Description of Service Casualty Office Databases

2-1. Introduction

The Director, Washington Headquarters Services, Directorate for Information Operations and Reports (WHS/DIOR), Office of the Secretary of Defense, tracks all active duty deaths* from hostile and nonhostile actions (e.g., accidents, illnesses, suicides, homicides, and deaths that have a pending or undetermined cause). In addition, each service maintains a service casualty office as the focal point on all casualty matters.

2-2. Mission

The Washington Headquarters Services, Directorate for Information Operations and Reports.

- Maintains and operates the DoD Worldwide Casualty System (WCS) database.
- Captures hostile and nonhostile casualty information on all service personnel who die while on active duty.
- Consolidates casualty information from all services on a fiscal-year basis.

The Casualty Office for Each Service.

- Acts as the focal point on all casualty matters.
- Maintains the capability to provide casualty notification, casualty assistance, and individual casualty recording and reporting.
- Verifies that the casualty information is documented and provided to the WHS/DIOR within prescribed time constraints.

* The terms "death," "casualty," and "fatality" are defined the same and used interchangeably throughout the atlas.

2-3. Purpose of the Casualty Databases

The casualty databases capture all active duty deaths caused by accidents, illnesses, suicides, homicides, hostile actions, and deaths that have a pending or undetermined cause. The databases are used to:

- Track and update reportable deaths.
- Generate required reports.
- Compile mailing labels.
- Produce required correspondence and develop statistical models and information.

Each service uses its own database to document and provide casualty information to WHS/DIOR, as required by DoDI 1300.18. The databases are:

- Army Casualty Information Processing System (ACIPS).
- Navy Automated Casualty Monitoring Program (ACMP).
- Marine Corps Casualty Assistance Information System (CAIS).
- Air Force Casualty Accountability System.

2-4. Authority

The basic implementing DoDI is the Military Personnel Casualty Matters, Policies and Procedures Instruction (DoDI 1300.18), from which all services generate appropriate directives. Each service may have additional requirements as outlined in their own governing instructions, manuals, or orders:

- Army—Casualty Operations/Assistance/Insurance (AR 600-8-1).
- Navy—Personnel Casualty Reports (MILPERSMAN 4210100).
- Marine Corps—Casualty Procedures Manual (MCO P3040.4).
- Air Force—Casualty Service Program (AFINST 36-3002).

2-5. Comparison of the Minimum Basic Data Set Variables and Service Casualty Databases

Each service identified their database's casualty variables for *unintentional injuries* using the questionnaire discussed in Chapter 1 (see pages 1-23 through 1-27). These variables were compared to the MBDS for unintentional injury surveillance recommended by Lund, Holder, and Smith.* A comparison is presented in **Table 2-1**.

The services were not asked to identify their database's casualty variables for *intentional injuries*.† Additional data required to satisfy the MBDS for intentional injuries include circumstances or motive surrounding injury event, drugs or alcohol involved, weapon(s) involved, relationship and demographics of victim and perpetrator, and source of data.

* Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994.

† Powell, K. and J. Kraus. Minimum Basic Data Set, Intentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:35-1 to 35-2, 1994.

Table 2-1. Comparison of the Recommended Elements from the Minimum Basic Data Set Variables for Unintentional Injury Surveillance and Their Availability from the Service Casualty Databases

Variables	All Services Worldwide Casualty System (WCS)	Army Casualty Information Processing System (ACIPS)	Navy Automated Casualty Monitoring Program (ACMP)	Marine Corps Casualty Assistance Information System (CAIS)	Air Force Casualty Accountability System
Intent*	Y	Y	Y	Y	Y
Age of Injured*	Y	Y	U	Y	Y
Gender*	Y	Y	Y	Y	Y
Race*	Y	Y	U	Y	Y
Place of Residence *	NS	NS	NS	NS	NS
Date of Injury Event*	Y	Y	Y	Y	Y
Place of Occurrence (home, work, etc.)*	Y	Y	N	Y	Y
Address of Place of Occurrence*	NS	NS	NS	NS	NS
Activity When Injury Occurred*	Y	Y	N	Y	Y
Mechanism of Accident/Event*	N	Y	N	Y	Y
Type of Injury/Body Location*	Y	Y	Y	Y	Y
Outcome of Injury					
Type of Treatment†	N	N	U	N	Y
Dates of Treatment†	N	N	U	N	Y
Date Admitted to Hospital†	N	N	U	N	Y
Date Discharged from Hospital†	N	N	U	N	Y

Table 2-1.—Continued

Variables	All Services Worldwide Casualty System (WCS)	Army Casualty Information Processing System (ACIPS)	Navy Automated Casualty Monitoring Program (ACMP)	Marine Corps Casualty Assistance Information System (CAIS)	Air Force Casualty Accountability System
Nature of Disability†	N	N	U	Y	N
Degree of Disability (fit for duty, temporary disability retired list, etc.)†	N	N	U	Y	N
Severity of Injury†	N	N	U	Y	N
Days of Limited Duty†	N	N	U	N	N
Days in Hospital†	N	N	U	N	N
Cost of Treatment†	N	N	U	N	N

Y = available in database.

N = not in database.

U = unknown; response not provided on questionnaire.

NS = not solicited on questionnaire.

* Recommended variables for databases designed for unintentional injury surveillance (Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994).

† Example of an outcome variable deemed appropriate for databases with potential for surveillance of unintentional injuries to U.S. active duty military personnel.

Section II. Service Casualty Office Data

2-6. Department of Defense (All Services)

The DoD casualty data for active duty personnel are presented in three parts:

- The DoD Summary. The DoD casualty data presented in this section are summarized in two tables.
 - The overall summary is presented in Table 2-2.
 - The data in figures 2-1 through 2-4 and 2-6 through 2-8 are summarized in Table 2-3.
- Magnitude of the Injury Problem Relative to Other Causes of Death.
 - The distribution of deaths for FY 1993 and 1994 are displayed in figures 2-1 and 2-2, respectively.
 - The gender rates for CY 1993 are displayed in figures 2-3 and 2-4.
- Trends of Military Injury-Related Deaths Relative to Other Causes Over Time.
 - The rates of death for FY 1980-1995 are displayed in figures 2-5 and 2-6.
 - The gender rates for CY 1980-1993 are displayed in figures 2-7 and 2-8.

The DoD Summary.

Table 2-2 displays an overall summary of DoD casualty data for active duty personnel from all services by:

- Gender.
- Year.
- Total deaths.
- Rates and trends of deaths.

Table 2-3 displays the summary of DoD casualty data for active duty personnel by:

- Casualty types.
- Distribution (%) of deaths.
- Rates and trends of deaths.

Tables 2-2 and 2-3 also display conclusions drawn from these casualty data.

Table 2-2. Overall Summary of DoD Casualty (Fatality) Data for Active Duty Personnel

Year	Total DoD Population	Deaths		Rates and Trends of Deaths			Conclusion
		Total	n/100,000 Personnel/Year	n/100,000 Personnel/Year		Trend, % Change (FY 1980-1995)	
All	—	—	—	117 (FY80)	69 (FY95)	Down 41%	Overall casualty rates for the military declined greatly from FY 1980 to FY 1995 due largely to decreases in accidental deaths.
FY80-95	1,705,103	1,245	73	—	—	—	
FY93	1,610,490	1,108	69	—	—	—	
FY94	1,464,113	1,143	78	—	—	—	
Men	196,707	67	34	—	—	—	
CY93							

Table 2-3. Summary of DoD Casualty (Fatality) Data for Active Duty Personnel by Type of Casualty—Distribution, Rates, and Trends of Deaths

Casualty Types	Distribution (%) of Deaths				Rates and Trends of Deaths			Conclusions
	Men and Women		Men	Women	n/100,000 Personnel/Year		Trend, % Change	
	FY 1993 n = 1,705,103	FY 1994 n = 1,610,490	CY 1993 n = 1,464,113	CY 1993 n = 196,707				
Accidents								Death Rates <ul style="list-style-type: none"> Death rates are so low that a single event such as the Gander, Newfoundland, crash or the Beirut bombing can distort the trends. Death rates among women exhibited some wide variations due largely to fluctuations in low numbers of annual deaths in cause-specific categories. Accidents <ul style="list-style-type: none"> About half of deaths are accidental, and another quarter are caused by violent injuries (suicides and homicides combined). Accidental injury trends are downward and influence overall downward trends for all deaths. Although accident rates declined, accidental deaths continued to be greater than any other cause of death. Suicides and Homicides <ul style="list-style-type: none"> Violent injuries (suicides and homicides combined) are the second leading cause of death. Homicide rates for women are only slightly higher than those for men, but they account for a much greater percentage of total deaths. Illnesses <ul style="list-style-type: none"> Illness rates declined, while other rates remained fairly steady. Illnesses are almost as important a cause of death for women as accidental injuries; this is not true for men. In recent years, male and female illness rates are similar. Hostile Actions <ul style="list-style-type: none"> In any given year, hostile actions never accounted for more than 10 injuries per 100,000 personnel, or less than 9% of all deaths.
All	54%	49%	—	—	77 (FY80)	37 (FY95)	Down 52%	
Men	—	—	53%	—	81 (CY80)	41 (CY93)	Down 49%	
Women	—	—	—	35%	33 (CY80)	12 (CY93)	Down 64%	
Suicides								
All	19%	20%	—	—	—	—	—	
Men	—	—	19%	—	12 (CY80)	15 (CY93)	Up 25%	
Women	—	—	—	13%	5 (CY80)	5 (CY93)	Same	
Illnesses								
All	17%	19%	—	—	20 (FY80)	11 (FY95)	Down 45%	
Men	—	—	17%	—	21 (CY80)	14 (CY93)	Down 33%	
Women	—	—	—	32%	10 (CY80)	11 (CY93)	Up 10%	
Homicides								
All	7%	8%	—	—	—	—	—	
Men	—	—	6%	—	8 (CY80)	5 (CY93)	Down 38%	
Women	—	—	—	16%	9 (CY80)	6 (CY93)	Down 33%	
Hostile Actions								
All	1%	2%	—	—	—	—	—	
Men	—	—	3%	—	—	—	—	
Women	—	—	—	—	—	—	—	
Other*								
All	2%	2%	—	—	—	—	—	
Men	—	—	2%	—	—	—	—	
Women	—	—	—	4%	—	—	—	

* Deaths that have a pending or undetermined cause.

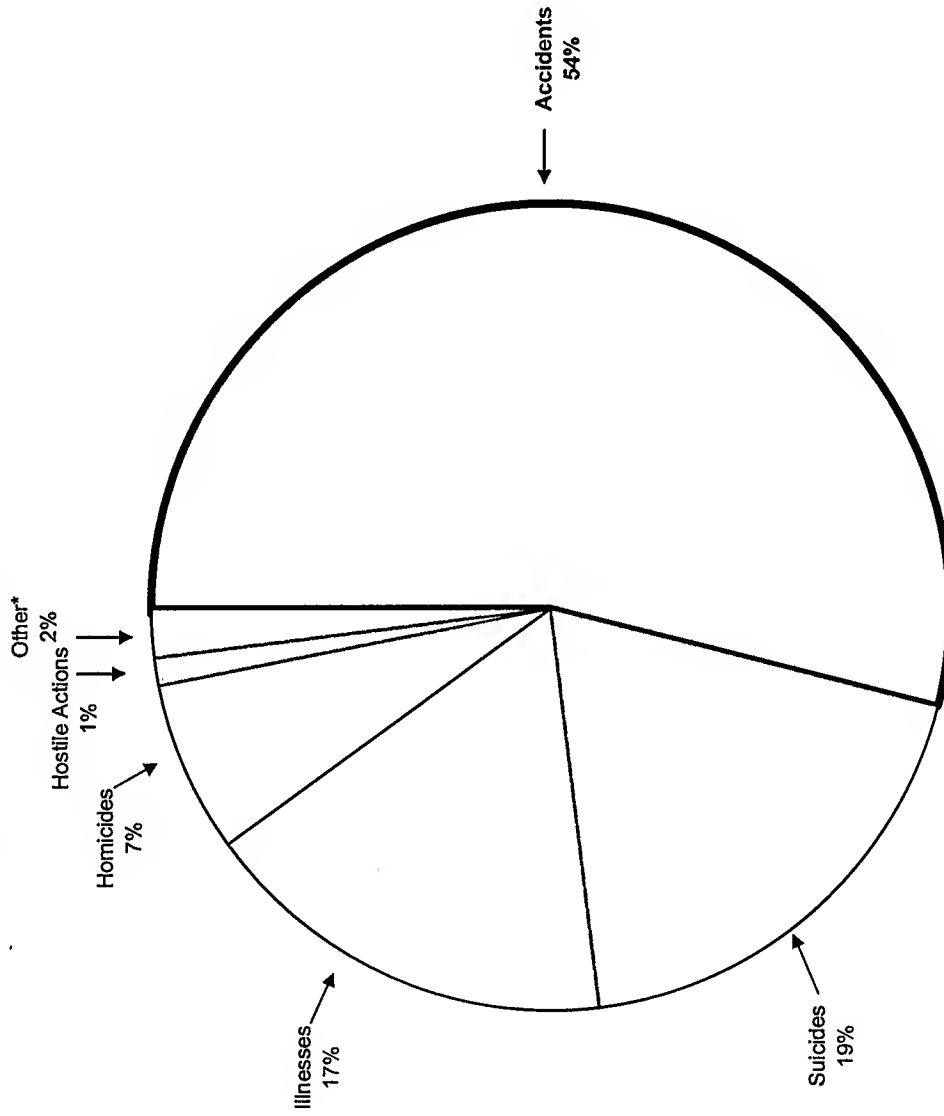
Magnitude of the Injury Problem Relative to Other Causes of Death.

Figure 2-1 illustrates the distribution of deaths by casualty type for active duty personnel from all services for FY 1993:

- Accidents—54%.
- Suicides—19%.
- Illnesses—17%.
- Homicides—7%.
- Hostile actions—1%.
- Other (deaths that have a pending or undetermined cause)—2%.

Accidents, the leading cause of death, occur more than two and a half times as often as suicides, the second leading cause of death. The total number of deaths for FY 1993 was 1,245 out of a population of 1,705,103, or 73 deaths per 100,000 personnel.

DoD - Distribution (%) of Deaths by Casualty Type for Active Duty Personnel, FY 1993



n (deaths) = 1,245.
population = 1,705,103.

* Deaths that have a pending or undetermined cause.

Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

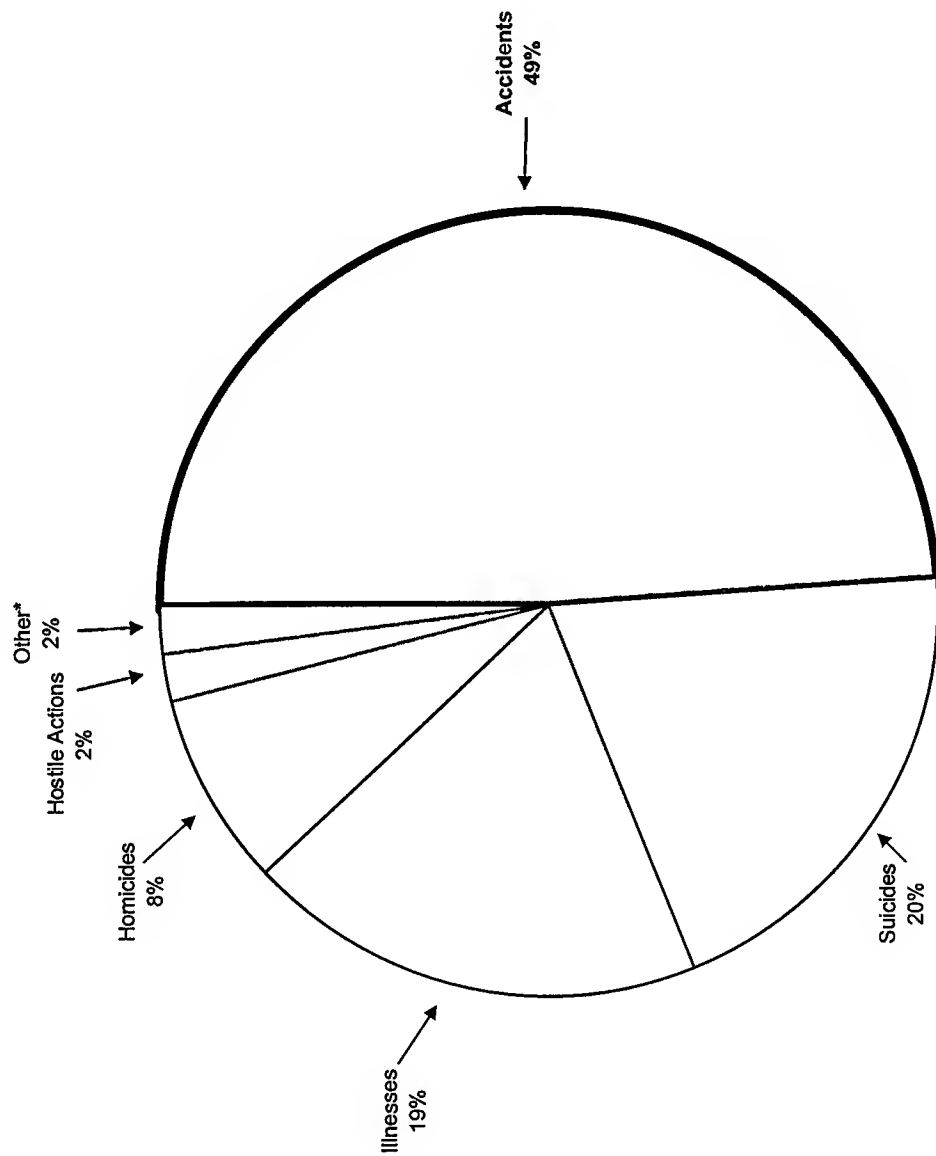
Figure 2-1

Figure 2-2 illustrates the distribution of deaths by casualty type for active duty personnel from all services for FY 1994:

- Accidents—49%.
- Suicides—20%.
- Illnesses—19%.
- Homicides—8%.
- Hostile actions—2%.
- Other (deaths that have a pending or undetermined cause)—2%.

Accidents, the leading cause of death, occur almost two and a half times as often as suicides, the second leading cause of death. The total number of deaths for FY 1994 was 1,108 out of a population of 1,610,490, or 69 deaths per 100,000 personnel.

DoD - Distribution (%) of Deaths by Casualty Type for Active Duty Personnel, FY 1994



n (deaths) = 1,108.
 population = 1,610,490.
 * Deaths that have a pending or undetermined cause.

Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIORM07-96/01).

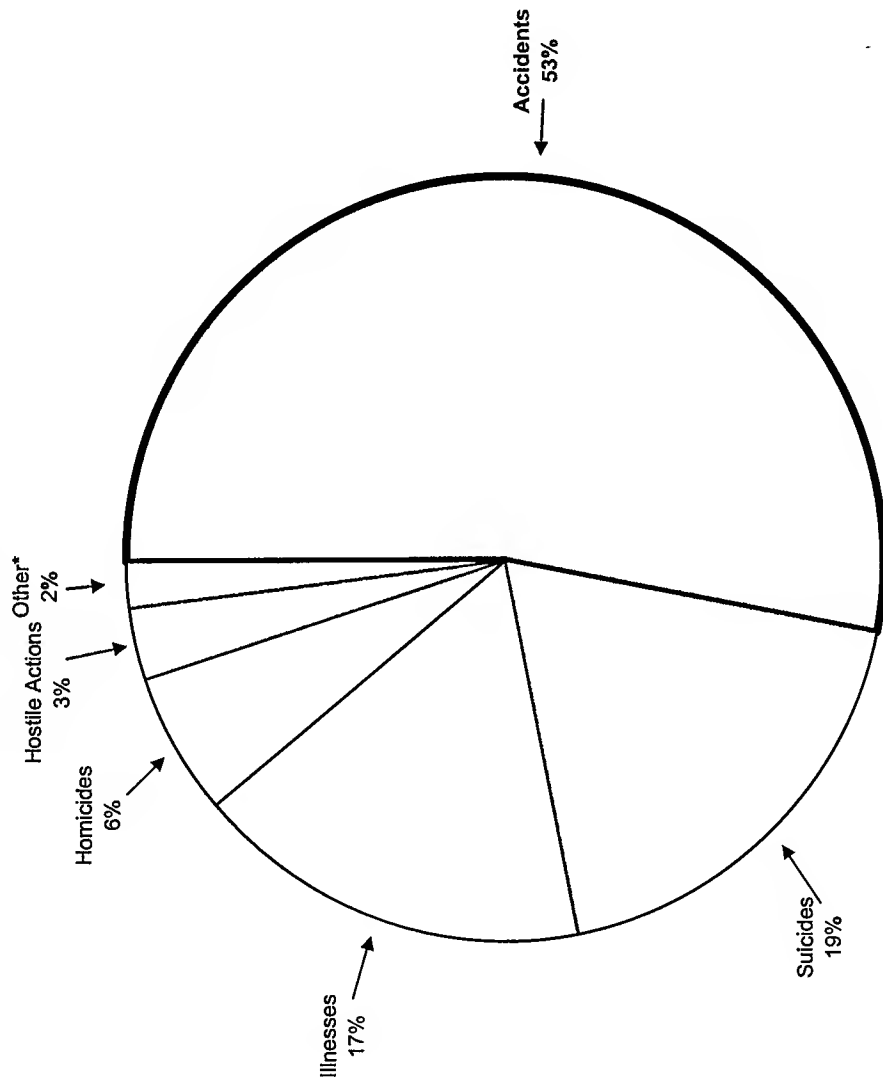
Figure 2-2

Figure 2-3 illustrates the distribution of deaths by casualty type for active duty men from all services for CY 1993:

- Accidents—53%.
- Suicides—19%.
- Illnesses—17%.
- Homicides—6%.
- Hostile actions—3%.
- Other (deaths that have a pending or undetermined cause)—2%.

Accidents, the leading cause of death, occur more than two and a half times as often as suicides, the second leading cause of death. The total number of male deaths for CY 1993 was 1,143 out of a population of 1,464,431, or 78 deaths per 100,000 personnel.

DoD - Distribution (%) of Deaths by Casualty Type for Active Duty Men, CY 1993



n (deaths) = 1,143.
population (men) = 1,464,431.

* Deaths that have a pending or undetermined cause.

Source: Obtained from the Defense Manpower Data Center by CDR James Helmkamp, U.S. Navy, for the *National Mortality Profile of Active Duty Personnel in the U.S. Armed Forces, 1980-1994*, a NIOSH report (Pub 96-103).

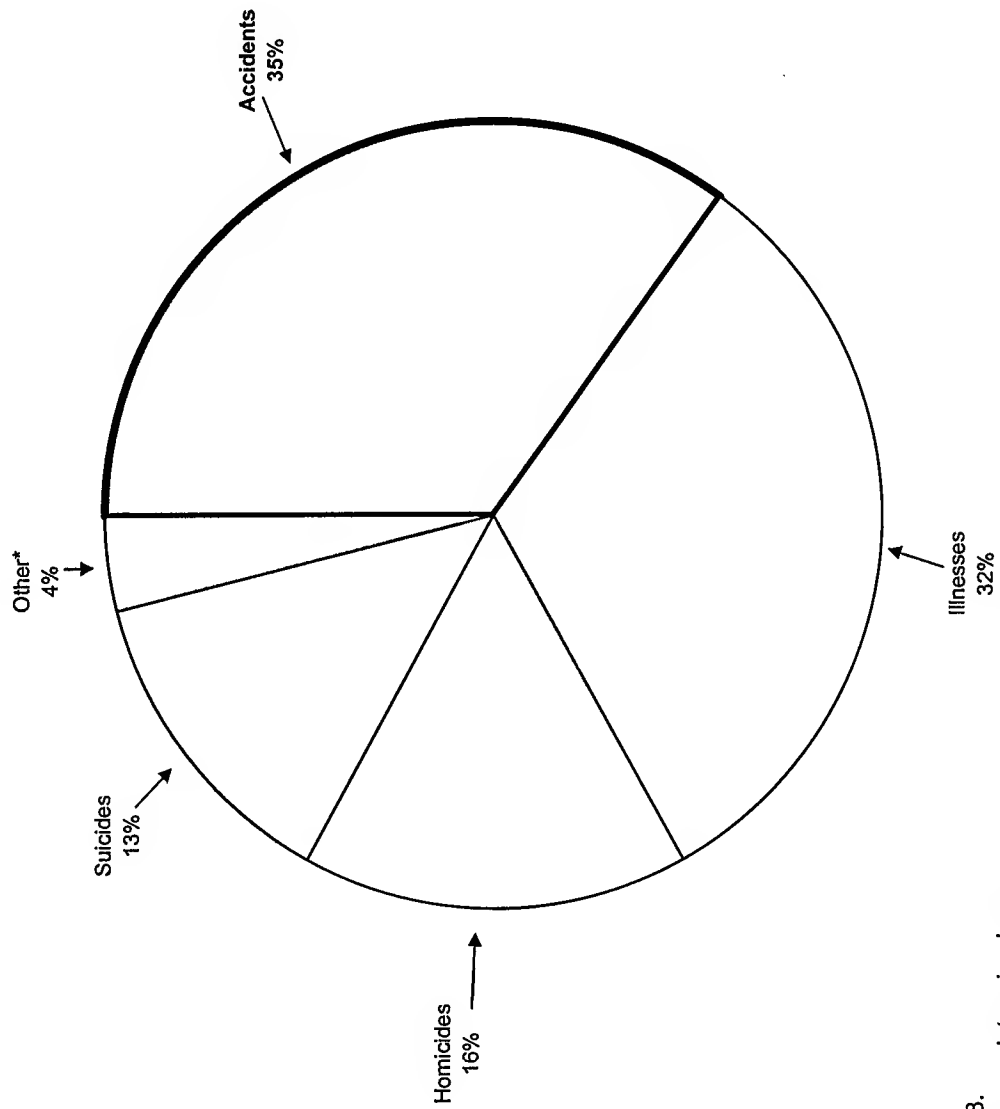
Figure 2-3

Figure 2-4 illustrates the distribution of deaths by casualty type for active duty women from all services for CY 1993:

- Accidents—35%.
- Illnesses—32%.
- Homicides—16%.
- Suicides—13%.
- Other (deaths that have a pending or undetermined cause)—4%.

Accidents, the leading cause of death, occur only slightly more often than illnesses, the second leading cause of death. The total number of female deaths for CY 1993 was 67 out of a population of 196,708, or 34 deaths per 100,000 personnel.

DoD - Distribution (%) of Deaths by Casualty Type for Active Duty Women, CY 1993

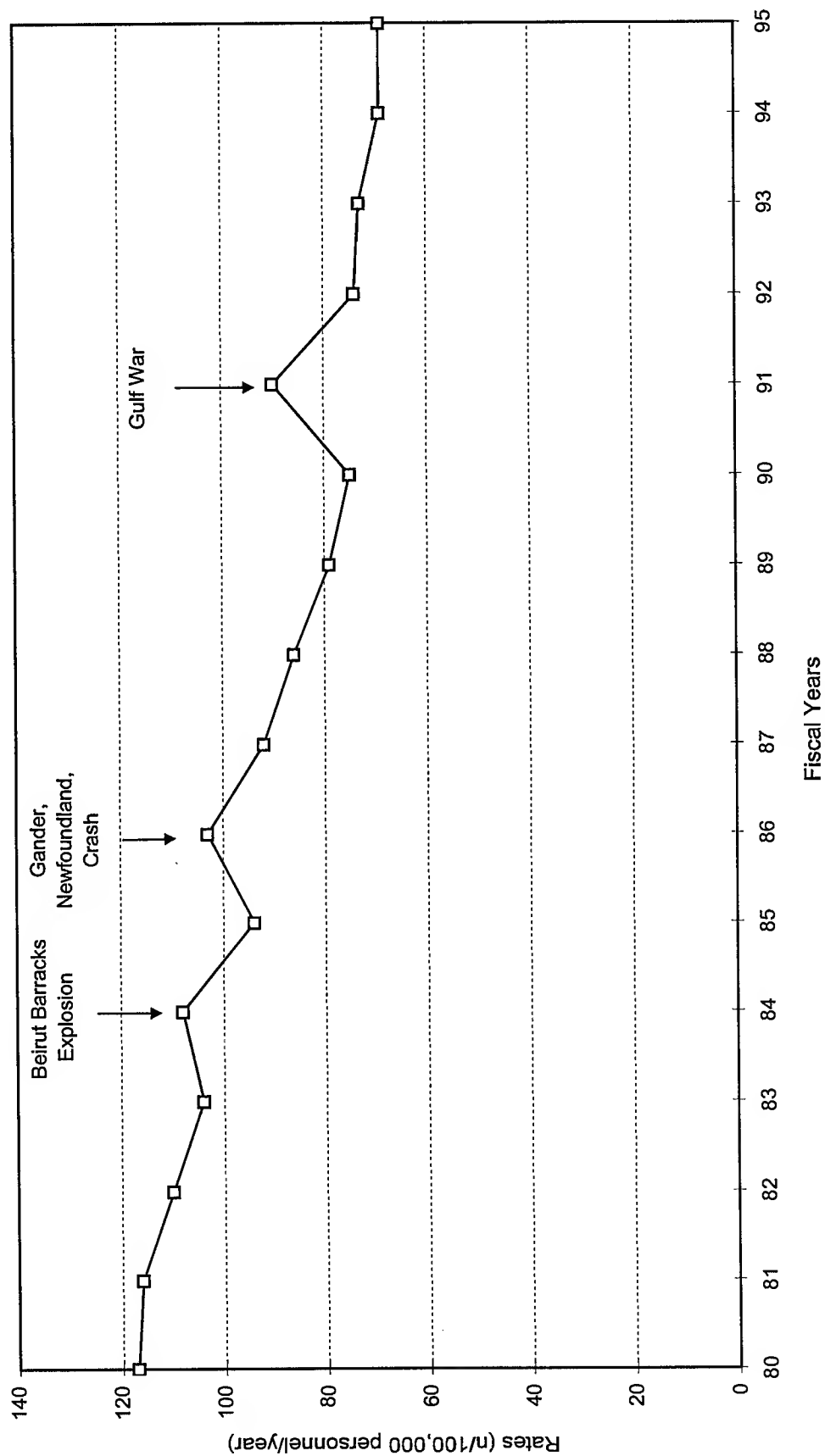


n (deaths) = 67.
 population (women) = 196,708.
 * Deaths that have a pending or undetermined cause.

Figure 2-4

Source: Obtained from the Defense Manpower Data Center by CDR James Helmkamp, U.S. Navy, for the *National Mortality Profile of Active Duty Personnel in the U.S. Armed Forces, 1980-1994*, a NIOSH report (Pub 96-103).

DoD - Overall Rates of Death for Active Duty Personnel, FY 1980-1995



Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 2-5

Figure 2-6 illustrates the rates of death by casualty type for active duty personnel from all services from FY 1980-1995. Accident and illness rates declined for all services, while other rates remained fairly steady for the period:

- Accident casualty rates decreased 52% from 77 per 100,000 personnel in FY 1980 to 37 per 100,000 personnel in FY 1995.
- Illness casualty rates decreased 45% from 20 per 100,000 personnel in FY 1980 to 11 per 100,000 personnel in FY 1995.

In spite of a substantial decrease in the rate of accidental deaths since CY 1980, the accident rates are still greater than all other causes combined.

Worksheet Data for Figure 2-6

Casualty Types	DoD - Rates of Death by Fiscal Year*															
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
(Rank Based on 1995 Data)																
Accidents	77	73	71	66	62	56	68	53	52	50	42	47	39	39	34	37
Suicides	12	11	12	11	10	13	12	12	14	11	13	13	13	15	15	15
Illnesses	20	23	21	19	17	19	17	18	15	15	14	18	15	15	14	11
Homicides	8	8	5	5	6	5	5	4	5	3	4	5	7	5	6	7
Hostile Actions	0.05	0	0	0.3	13	0.2	0.09	1	0.1	0	1	7	0.05	0.6	1	1
Other	0.7	0.4	0.8	1	0.7	1	1	1	1	2	2	2	2	2	1	1

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

DoD - Rates of Death by Casualty Type for Active Duty Personnel, FY 1980-1995

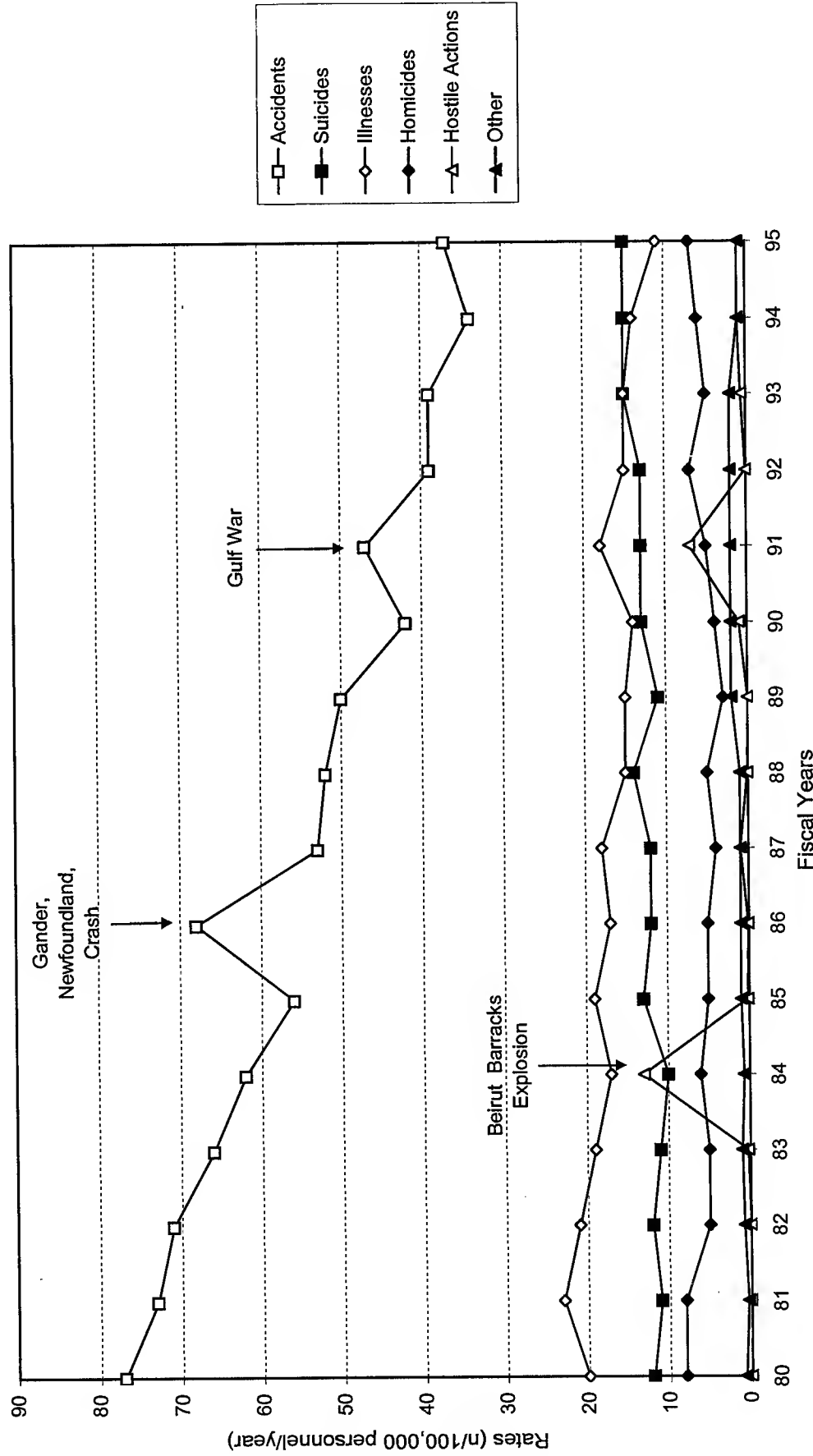


Figure 2-6

Source: Obtained from the Defense Manpower Data Center by CDR James Helmkamp, U.S. Navy, for the *National Mortality Profile of Active Duty Personnel in the U.S. Armed Forces, 1980-1994*, a NIOSH report (Pub 96-103).

Figure 2-7 illustrates the rates of death by casualty type for active duty men from all services for CY 1980-1993:

- Male accident casualty rates decreased 49% from 81 per 100,000 personnel in CY 1980 to 41 per 100,000 personnel in CY 1993.
- Male suicide casualty rates increased 25% from 12 per 100,000 personnel in CY 1980 to 15 per 100,000 personnel in CY 1993.
- Male illness casualty rates decreased 33% from 21 per 100,000 personnel in CY 1980 to 14 per 100,000 personnel in CY 1993.
- Male homicide casualty rates decreased 38% from 8 per 100,000 personnel in CY 1980 to 5 per 100,000 personnel in CY 1993.

Despite sharp decreases in accidental injury death rates since CY 1980, the accident rates are still higher than all other causes combined.

Worksheet Data for Figure 2-7

Casualty Types (Rank Based on 1993 Data)	DoD - Rates of Death for Men by Calendar Year*													
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Accidents	81	78	74	71	64	74	59	58	56	51	47	51	41	41
Suicides	12	12	13	10	11	14	13	13	14	12	12	14	13	15
Illnesses	21	23	28	21	19	18	19	18	16	15	14	17	15	14
Homicides	8	7	5	5	4	5	5	5	4	3	3	6	6	5
Hostile Actions	0	0.2	0	14	0.4	0.5	0	2	0	1	0	10	0	2
Other	0.6	1.3	1	1	0.9	1	2	1	1	2	2	2	3	1

* Rates per 100,000 personnel calculated using denominator data in Table 1-8.

DoD - Rates of Death by Casualty Type for Active Duty Men, CY 1980-1993

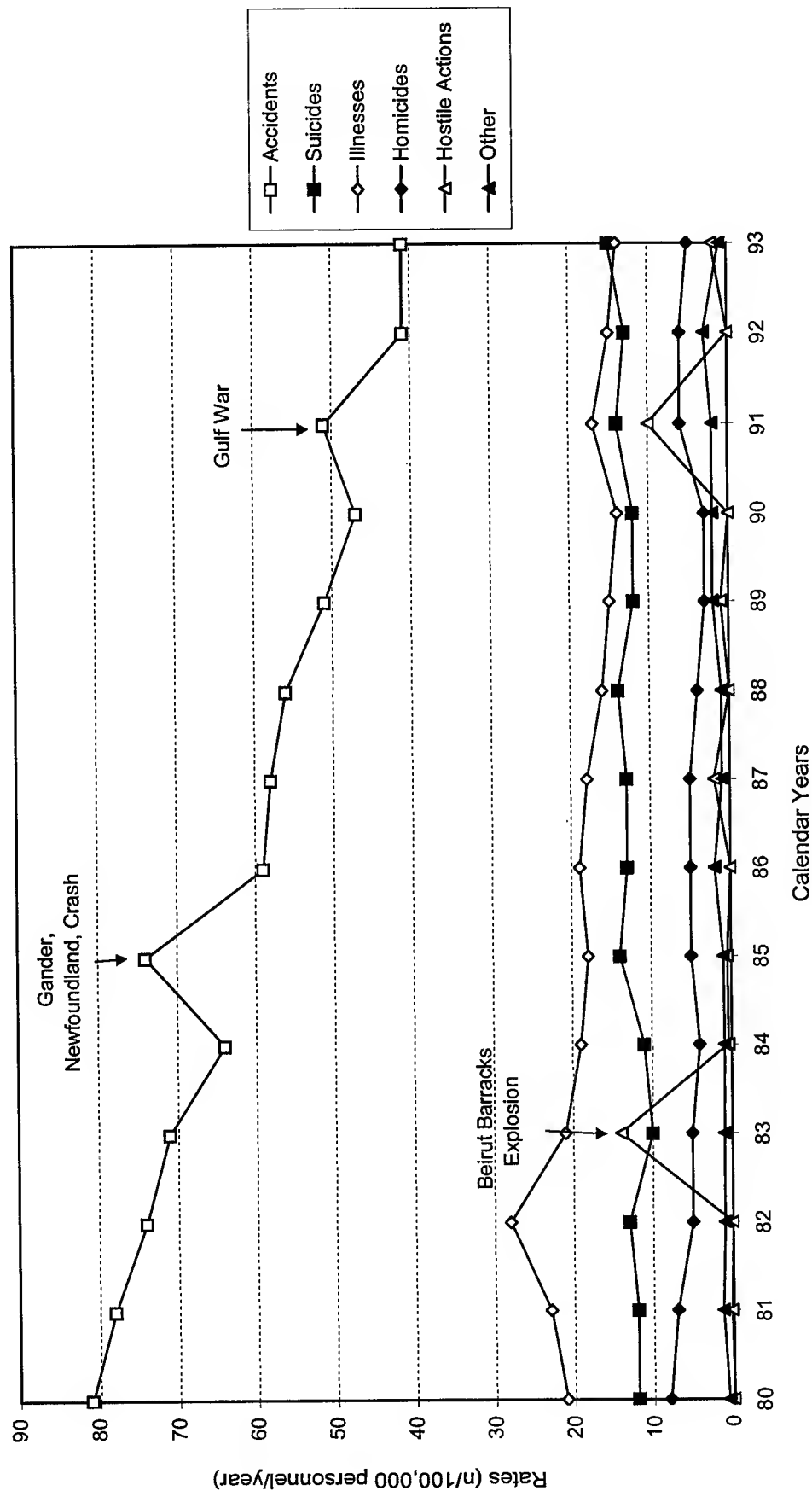


Figure 2-7

Source: Obtained from the Defense Manpower Data Center by CDR James Helmkamp, U.S. Navy, for the National Mortality Profile of Active Duty Personnel in the U.S. Armed Forces, 1980-1994, a NIOSH report (Pub 96-103).

Figure 2-8 illustrates the rates of death by casualty type for active duty women from all services for CY 1980-93:

- Female accident casualty rates decreased 64% from 33 per 100,000 personnel in CY 1980 to 12 per 100,000 personnel in CY 1993.
- Other female casualty rates were quite variable and showed no significant trend in either direction.

Death rates among women exhibited some wide variations from year to year. This variability was mostly due to the low number of deaths observed annually in a given cause-specific category. Also, the female population increased steadily through CY 1989 and then decreased steadily through CY 1993. Variability is due primarily to small numbers.

Comparing Figure 2-7 to Figure 2-8, the rate of fatal accidents among men averaged 2.7 times higher than the rate of accidents among women.

Worksheet Data for Figure 2-8

Casualty Types	DoD - Rates of Death for Women by Calendar Year*													
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Accidents	33	27	34	27	26	22	23	27	22	20	15	25	14	12
Illnesses	10	11	11	11	7	10	8	11	10	6	8	8	6	11
Homicides	9	4	7	9	7	9	6	7	5	4	6	6	7	6
Suicides	5	6	7	9	4	5	6	4	7	4	5	4	5	5
Hostile Actions	0	0	0	0	0	0	0	0	1	0	0	6	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	1	2	2

* Rates per 100,000 personnel calculated using denominator data in Table 1-8.

DoD - Rates of Death by Casualty Type for Active Duty Women, CY 1980-1993

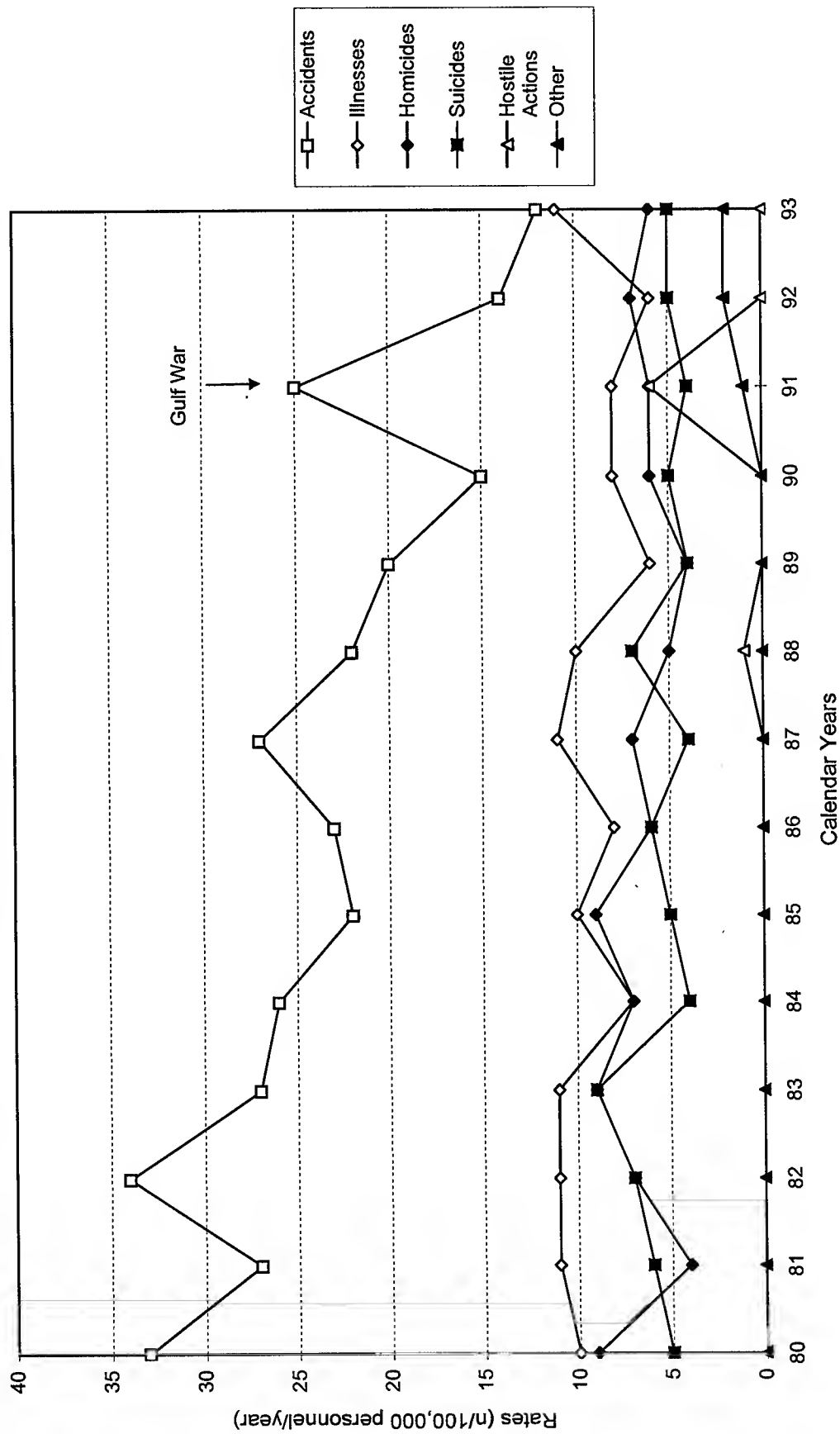


Figure 2-8

Source: Obtained from the Defense Manpower Data Center by CDR James Helmkamp, U.S. Navy, for the National Mortality Profile of Active Duty Personnel in the U.S. Armed Forces, 1980-1994, a NIOSH report (Pub 96-103).

2-7. Army

The Army casualty data for active duty personnel are presented in three parts:

- The Army Summary. The Army casualty data presented in this section are summarized in two tables.
 - The overall summary is presented in Table 2-4.
 - The data in figures 2-9, 2-10, and 2-12 are summarized in Table 2-5.
- Magnitude of the Injury Problem Relative to Other Causes of Death.
 - The distribution of deaths by casualty type for FY 1994 are displayed in Figure 2-9.
 - The distribution of deaths by specific causes for CY 1994 are displayed in Figure 2-10.
- Trends of Military Injury-Related Deaths Relative to Other Causes Over Time.
 - The overall rates of death for FY 1980-1995 are displayed in Figure 2-11.
 - The rates of death by casualty type for FY 1980-1995 are displayed in Figure 2-12.

The Army Summary.

Table 2-4. Overall Summary of Army Casualty (Fatality) Data for Active Duty Personnel

Year	Total Army Population	Deaths		Rates and Trends of Deaths			Conclusion
		Total	n/100,000 Personnel/Year	n/100,000 Personnel/Year	Trend, % Change (FY 1980-1995)		
FY80-95	—	—	—	115 (FY80)	76 (FY95)	Down 34%	Overall deaths decreased substantially, due primarily to decreases in accidental deaths.
FY94	541,343	492	91	—	—	—	
CY94	529,442	473	89	—	—	—	

Table 2-5. Summary of Army Casualty (Fatality) Data for Active Duty Personnel by Type of Casualty—Distribution, Rates, and Trends of Deaths

Casualty Types	Distribution (%) of Deaths		Rates and Trends of Deaths			Conclusions
	FY 1994 (n = 541,343)	CY 1994 (n = 529,442)	n/100,000 Personnel/Year		Trend, % Change (FY 1980-1995)	
			FY 1980	FY 1995		
Accidents	49%	—	74	40	Down 46%	Distribution of Deaths <ul style="list-style-type: none">Accidental injuries, suicides, and homicides account for 76% of all deaths. Accidents <ul style="list-style-type: none">Accidental injuries are still the leading cause of death, even though accident rates declined steadily.Accidents occurred almost 2½ times as often as illnesses, the second leading cause of death. Hostile Actions <ul style="list-style-type: none">In the past 15 years, hostile actions never accounted for more than 15% of all deaths in any given year. Vehicle Accidents <ul style="list-style-type: none">Vehicle accidents are the leading cause of death.Vehicle accidents occurred 1½ times as often as gunshots, the second leading specific cause of death.
Illnesses	20%	—	21	17	Down 19%	
Suicides	18%	—	11	14	Up 27%	
Homicides	9%	—	8	4	Down 50%	
Hostile Actions	4%	—	.12	.39	Insignificant	
Top Five Specific Causes of Death						
Vehicle Accidents	—	32%	—	—	—	
Gunshots*	—	21%	—	—	—	
Heart Attacks	—	10%	—	—	—	
Fires and Burns	—	5%	—	—	—	
Training-related Accidents	—	5%	—	—	—	

* Includes all accidents, suicides, homicides, and hostile actions in which a gunshot was the causative factor.

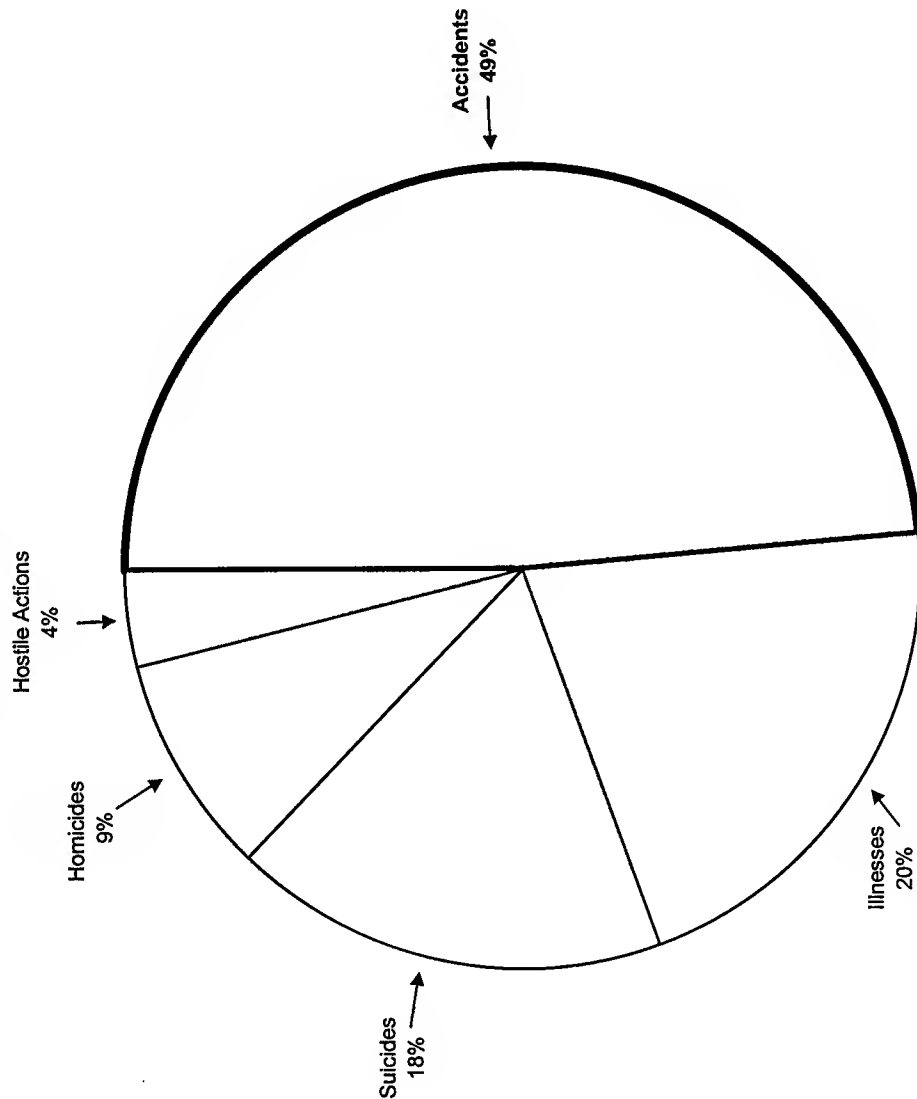
Magnitude of the Injury Problem Relative to Other Causes of Death.

Figure 2-9 illustrates the distribution of deaths by casualty type for active duty Army personnel for FY 1994:

- Accidents—49%.
- Illnesses—20%.
- Suicides—18%.
- Homicides—9%.
- Hostile actions—4%.

Accidents, the leading cause of death, occur almost two and a half times as often as illnesses, the second leading cause of death. The total number of deaths for FY 1994 was 492 out of a population of 541,343, or 91 deaths per 100,000 personnel.

Army - Distribution (%) of Deaths by Casualty Type for Active Duty Personnel, FY 1994



n (deaths) = 492.
population = 541,343.

Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIORM07-96/01).

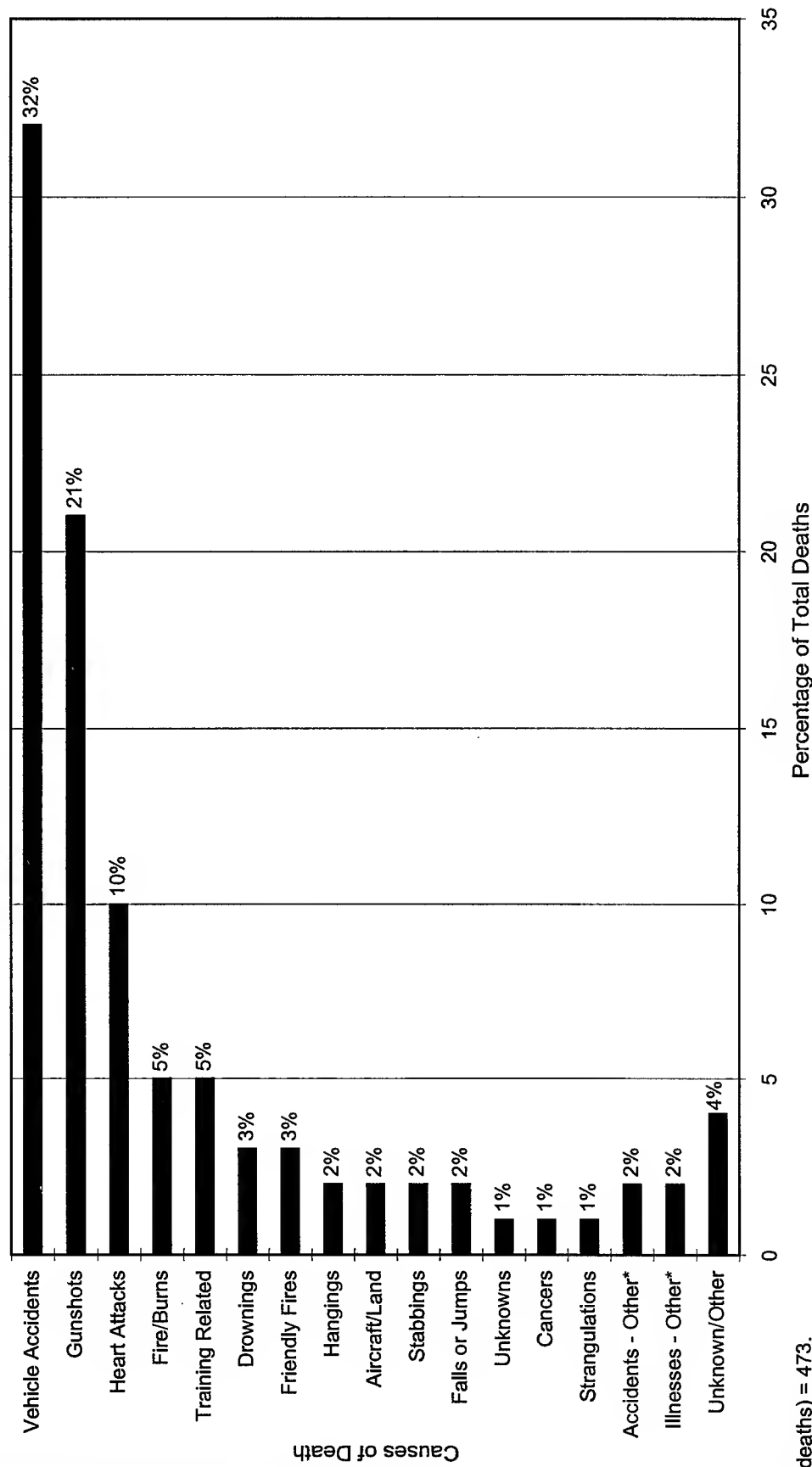
Figure 2-9

Figure 2-10 illustrates the distribution of deaths by more specific causes for active duty Army personnel for CY 1994. The top five specific causes of death were:

- Vehicle accidents—32%.
- Gunshots—21% (including all accidents, suicides, homicides, and hostile actions in which a gunshot was the causative factor).
- Heart attacks—10%.
- Fires and burns—5%.
- Training-related accidents—5%.

Vehicle accidents, the leading specific cause of death, occur one and a half times as often as deaths by gunshot, the second leading specific cause of death. The total number of deaths for CY 1994 was 473 out of a population of 529,442, or 89 deaths per 100,000 personnel.

Army - Distribution (%) of Deaths by Specific Cause for Active Duty Personnel, CY 1994



n (deaths) = 473.
 population = 529,442.
 * Includes causes accounting for only 1 or 2 deaths.

Source: Army Casualty Information Processing System, 1995, as reported to the DoD Injury Surveillance and Prevention Work Group and previously presented in the Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 2-10

Trends of Army Injury-Related Deaths Relative to Other Causes Over Time.

Figure 2-11 illustrates the overall rates of death for active duty Army personnel for FY 1980-1995. Death rates decreased 34% from 115 per 100,000 personnel in FY 1980 to 76 per 100,000 personnel in FY 1995. Since death rates are so low, single events like the Gander, Newfoundland, crash in 1986 and the Gulf War in 1991 strongly influence the overall rates.

Worksheet Data for Figure 2-11

		Army - Rates of Death by Fiscal Year*													
1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
115	121	122	107	103	106	133	98	91	78	86	107	80	82	91	76

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Army - Overall Rates of Death for Active Duty Personnel, FY 1980-1995

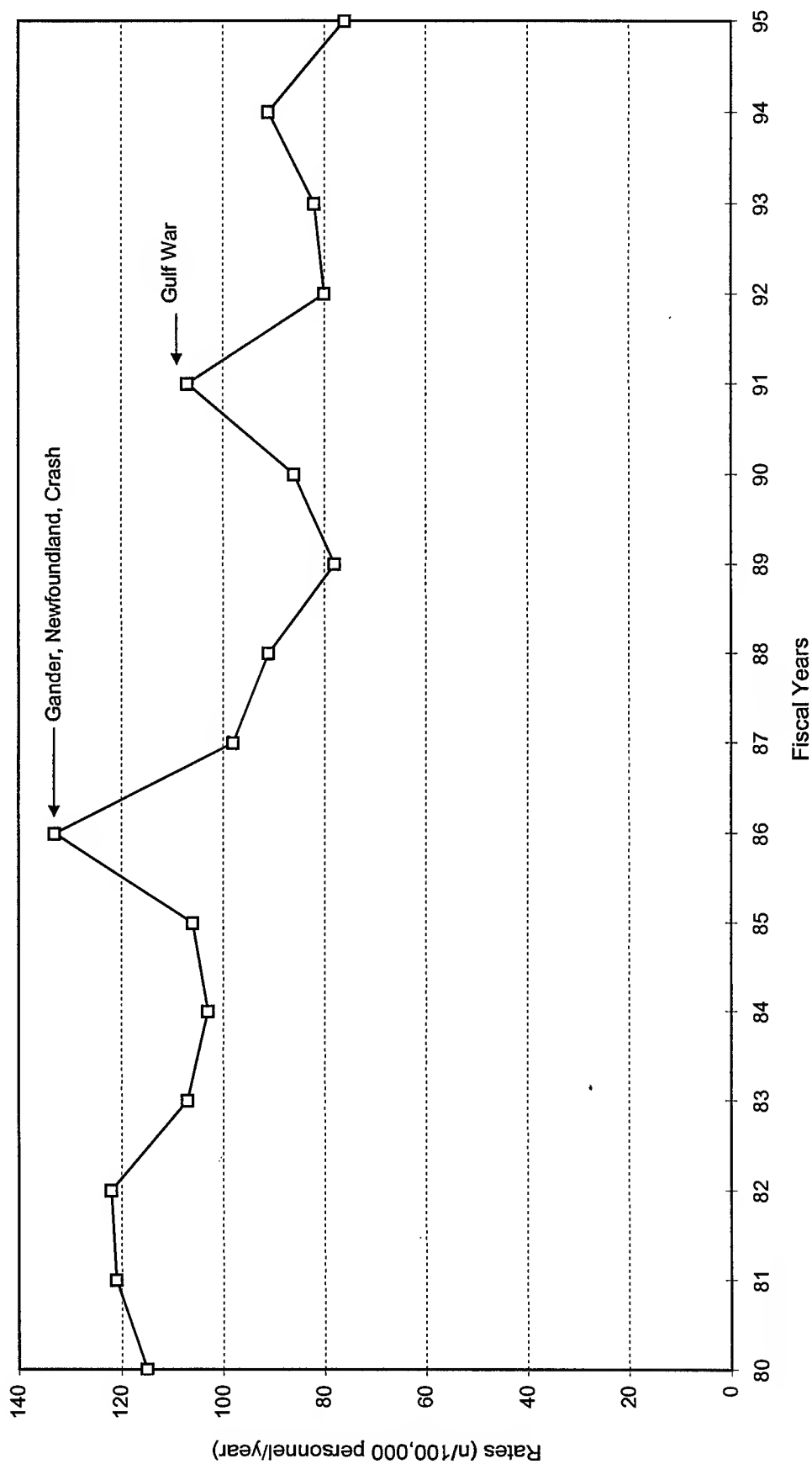


Figure 2-11

Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 2-12 illustrates the rates of deaths by casualty type for active duty Army personnel for FY 1980-1995.

- Accident casualty rates decreased 46% from 74 per 100,000 personnel in FY 1980 to 40 per 100,000 personnel in FY 1995.
- Illness, suicide, homicide, and hostile action casualty rates tended to vary slightly with no significant trends during the same period.

Worksheet Data for Figure 2-12

Casualty Types		Army - Rates of Death by Fiscal Year*															
		Worksheet Data not to Scale 2-12															
		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Accidents		74	73	76	66	69	62	92	60	55	49	49	52	40	43	44	40
Illnesses		21	26	28	22	21	21	19	21	18	14	17	21	17	15	19	17
Suicides		11	11	13	10	10	16	14	10	13	10	14	14	14	15	16	14
Homicides		8	10	7	7	5	7	6	7	5	3	3	6	8	8	8	4
Hostile Actions		0.12	0	0	0	2.2	0	0	0.12	0	0	2.4	13.8	0.16	1.4	3.5	0.39

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Army - Rates of Death by Casualty Type for Active Duty Personnel, FY 1980-1995

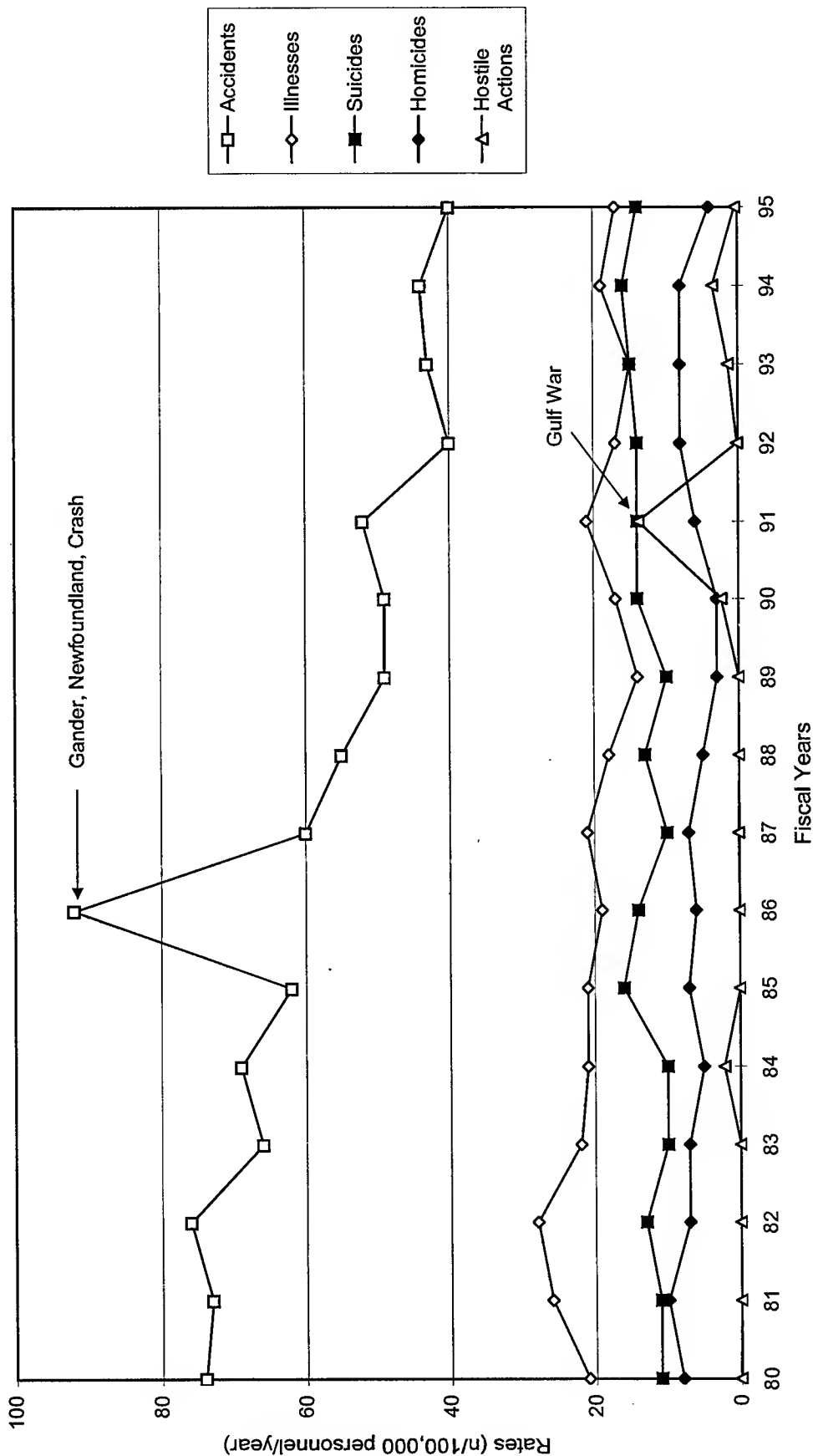


Figure 2-12

Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

2-8. Navy

The Navy casualty data for active duty personnel are presented in three parts:

- The Navy Summary. The Navy casualty data presented in this section are summarized in two tables.
 - The overall summary is presented in Table 2-6.
 - The data in figures 2-13, 2-14, and 2-16 are summarized in Table 2-7.
- Magnitude of the Injury Problem Relative to Other Causes Over Death.
 - The distribution of deaths by casualty type for FY 1994 are displayed in Figure 2-13.
 - The distribution of deaths by specific causes for CY 1994 are displayed in Figure 2-14.
- Trends of Military Injury-Related Deaths Relative to Other Causes of Time.
 - The overall rates of death for FY 1980-1995 are displayed in Figure 2-15.
 - The rates of death by casualty type for FY 1980-1995 are displayed in Figure 2-16.

The Navy Summary.

Table 2-6. Overall Summary of Navy Casualty (Fatality) Data for Active Duty Personnel

Table 2-6. Overall Summary of Navy Casualty (Fatality) Data for Active Duty Personnel							
Year	Total Navy Population	Deaths		Rates and Trends of Deaths			Conclusion
		Total	n/100,000 Personnel/Year	n/100,000 Personnel/Year	Trend, % Change (FY 1980-1995)		
FY80-95	—	—	—	130 (FY80)	63 (FY95)	Down 52%	Overall deaths decreased substantially, due primarily to decreases in accidental deaths.
FY94	468,662	274	58	—	—	—	
CY94	453,026	275	61	—	—	—	

Table 2-7. Summary of Navy Casualty (Fatality) Data for Active Duty Personnel by Type of Casualty—Distribution, Rates, and Trends of Deaths

Casualty Types	Distribution (%) of Deaths		Rates and Trends of Deaths			Conclusions
	FY 1994 (n = 468,662)	CY 1994 (n = 453,026)	n/100,000 Personnel/Year		Trend, % Change (FY 1980-1995)	
			FY 1980	FY 1995		
Accidents	48%	—	90	29	Down 68%	Distribution of Deaths <ul style="list-style-type: none">Accidental injuries, suicides, and homicides account for 76% of all deaths. Accidents <ul style="list-style-type: none">Accidental injuries continued to be the leading cause of death, although accident rates have declined.Accidents occurred almost 2½ times as often as suicides, the second leading cause of death. Vehicle Accidents <ul style="list-style-type: none">Vehicle accidents occurred over 1½ times as often as deaths by gunshot, the second leading specific cause of death.
Suicides	20%	—	12	14	Up 17%	
Illnesses	18%	—	19	7	Down 63%	
Homicides	8%	—	9	7	Down 22%	
Other*	6%	—	2	4	Up 100%	
Top Five Specific Causes of Death						
Vehicle Accidents	—	32%	—	—	—	
Gunshots	—	19%	—	—	—	
Heart Attacks	—	12%	—	—	—	
Aircraft Accidents at Sea/	—	5%	—	—	—	
Aircraft Landings	—	3%	—	—	—	
Drownings						

* Deaths that have a pending or undetermined cause.

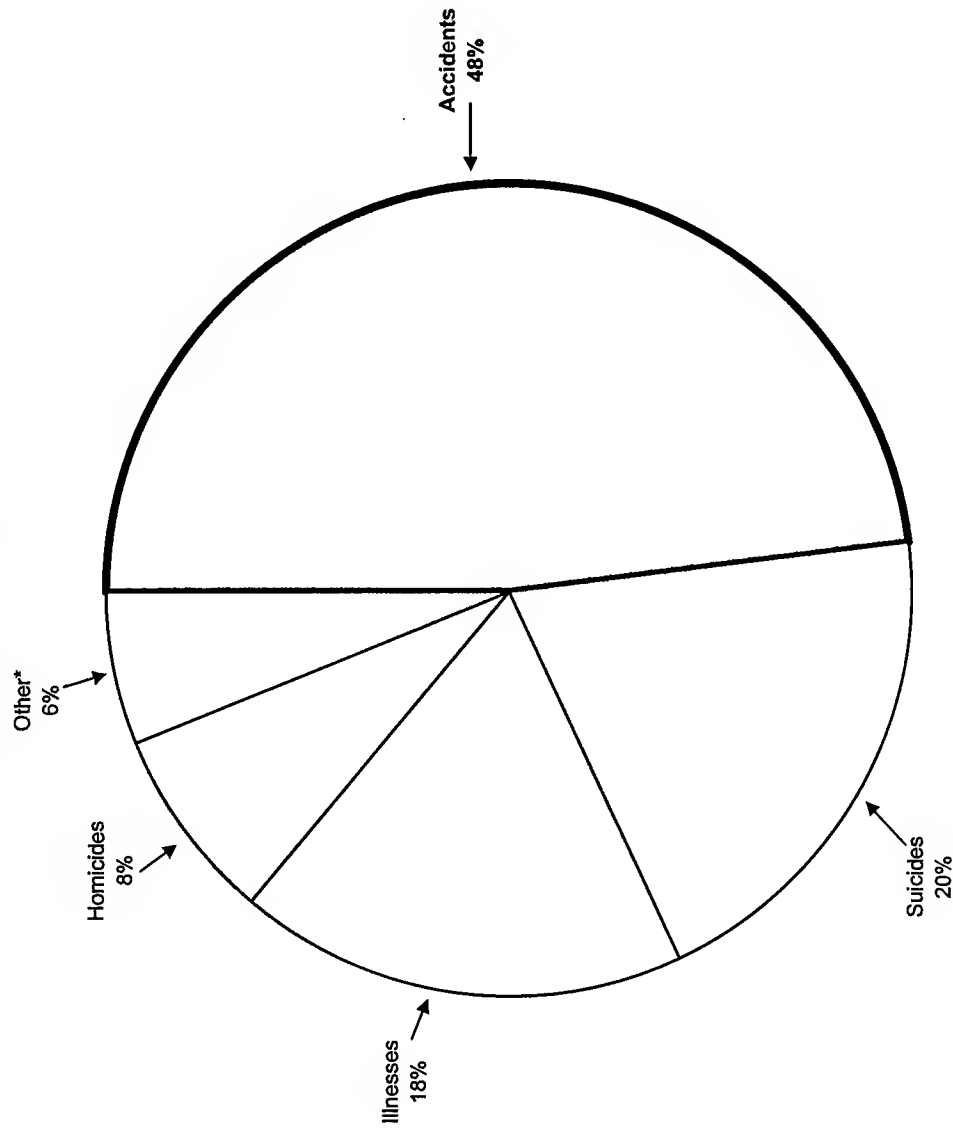
Magnitude of the Injury Problem Relative to Other Causes of Death.

Figure 2-13 illustrates the distribution of deaths by casualty type for active duty Navy personnel for FY 1994:

- Accidents—48%.
- Suicides—20%.
- Illnesses—18%.
- Homicides—8%.
- Other (deaths that have a pending or undetermined cause)—6%.

Accidents, the leading cause of death, occur almost two and a half times as often as suicides, the second leading cause of death. The total number of deaths for FY 1994 was 274 out of a population of 468,662, or 58 deaths per 100,000 personnel.

Navy Distribution (%) of Deaths by Casualty Type for Active Duty Personnel, FY 1994



n (deaths) = 274.
 population = 468,662.
 * Deaths that have a pending or undetermined cause.

Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

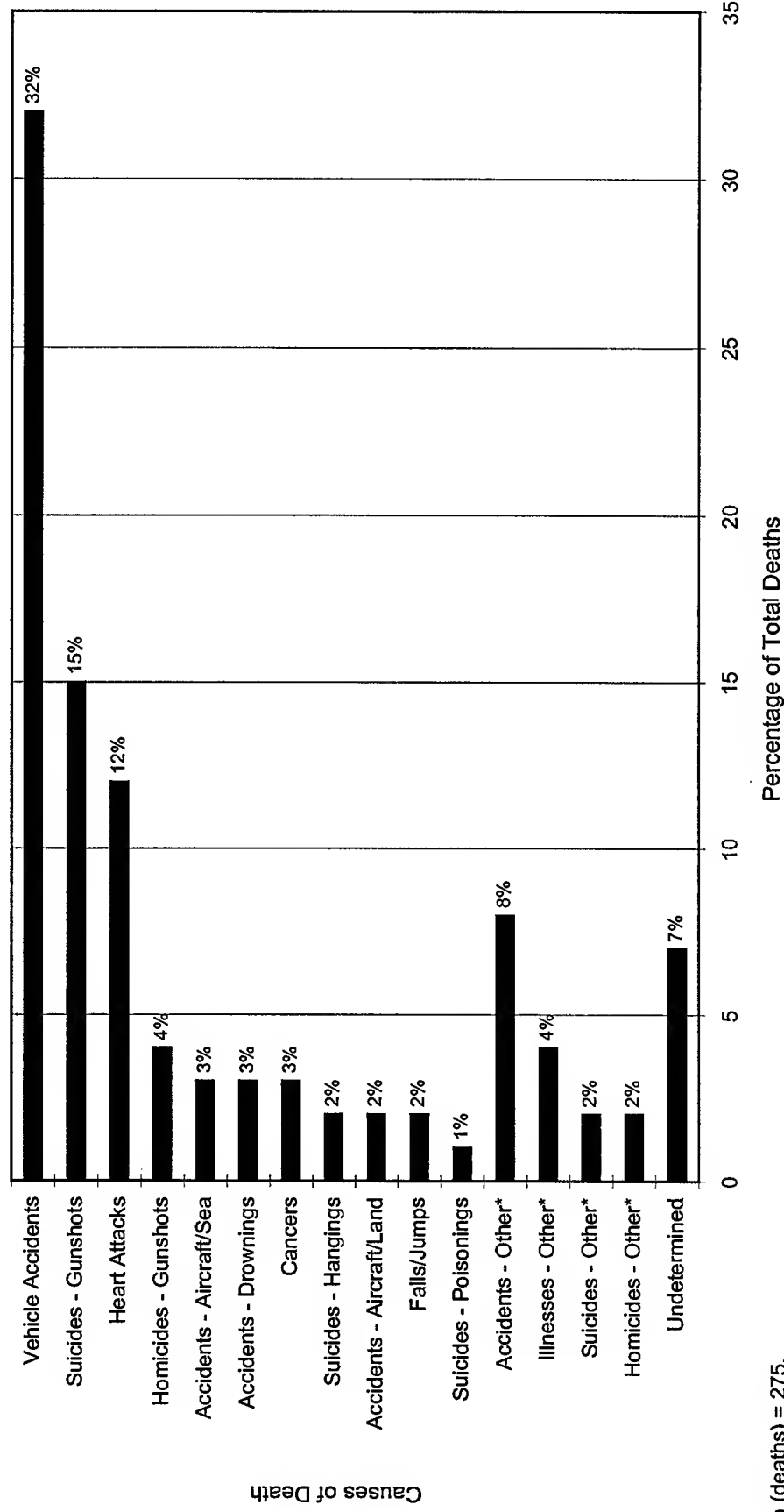
Figure 2-13

Figure 2-14 illustrates the distribution of deaths by more specific causes for active duty Navy personnel for CY 1994. The top five specific causes of death were:

- Vehicle accidents—32%.
- Gunshots—19% (suicides—15%, and homicides—4%).
- Heart attacks—12%.
- Aircraft accidents—5% (sea—3%; land—2%).
- Drownings and cancer—3% each.

Vehicle accidents, the leading specific cause of death, occur over one and a half times as often as deaths by gunshot, the second leading specific cause of death. The total number of deaths was 275 for CY 1994 out of a population of 453,026, or 61 deaths per 100,000 personnel.

Navy - Distribution (%) of Deaths by Specific Cause for Active Duty Personnel, CY 1994



n (deaths) = 275.

population = 453,026.

* Includes causes accounting for only 1 or 2 deaths each.

Source: Worldwide Casualty System Database, as reported to the DoD Injury Surveillance and Prevention Work Group and previously presented in *the Armed Forces Epidemiological Board Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 2-14

Trends of Military Injury-Related Deaths Relative to Other Causes Over Time.

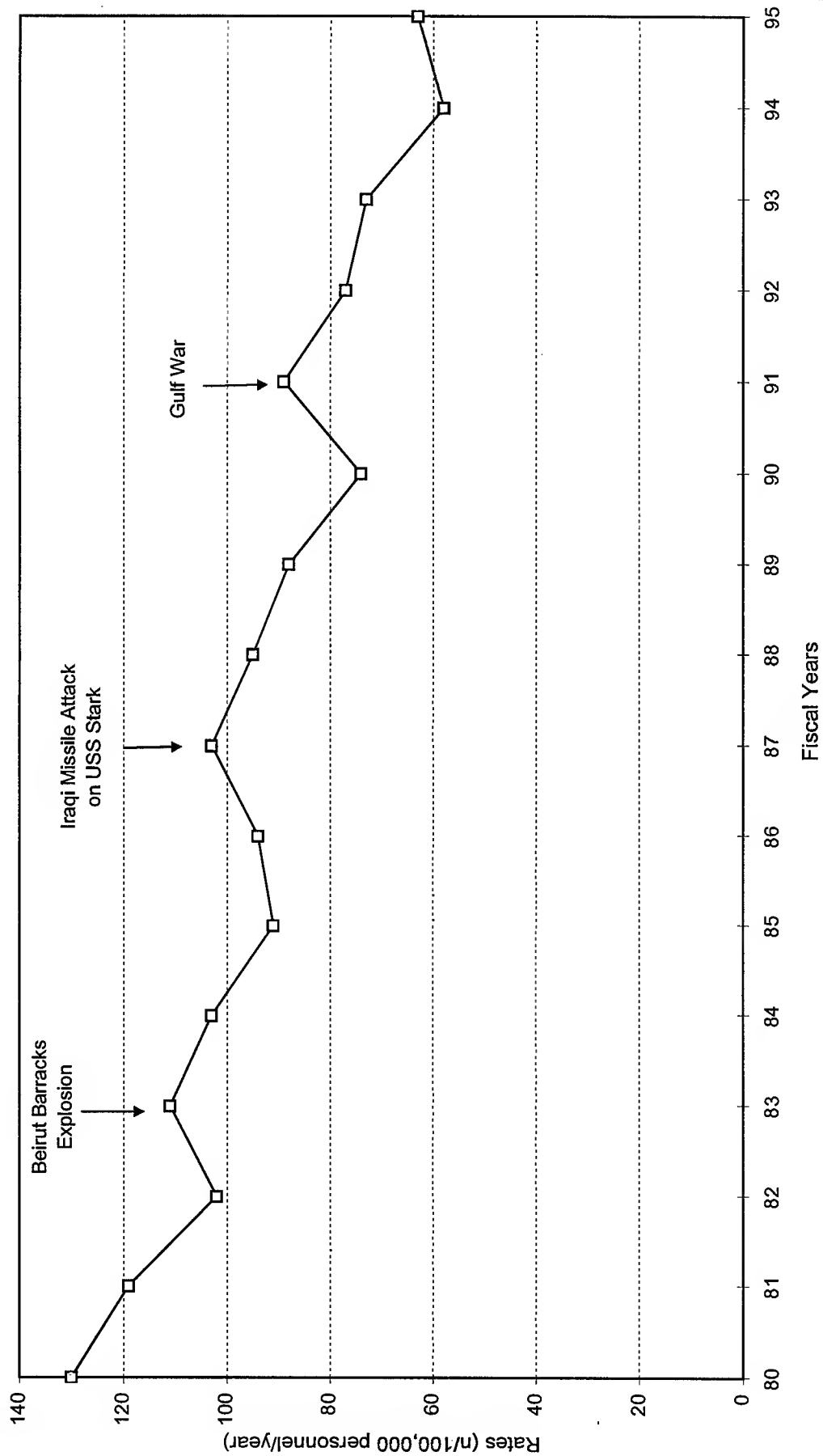
Figure 2-15 illustrates the overall rates of death for active duty Navy personnel for FY 1980-1995. Casualties decreased 52% from 130 per 100,000 personnel in FY 1980 to 63 per 100,000 personnel in FY 1995.

Worksheet Data for Figure 2-15

Worksheet Data for Figure 2-13																
Navy - Rates of Death by Fiscal Year*																
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
130	119	102	111	103	91	94	103	95	88	74	89	77	73	58	63	

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Navy - Overall Rates of Death for Active Duty Personnel, FY 1980-1995



Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-95/01).

Figure 2-15

Figure 2-16 illustrates the rates of death by casualty type for active duty Navy personnel for FY 1980-1995.

- Accident casualty rates decreased 68% from 90 per 100,000 personnel in FY 1980 to 29 per 100,000 personnel in FY 1995.
- Illness casualty rates decreased 63% from 19 per 100,000 personnel in FY 1980 to 7 per 100,000 personnel in FY 1995.
- The remaining casualty types changed little for the period.

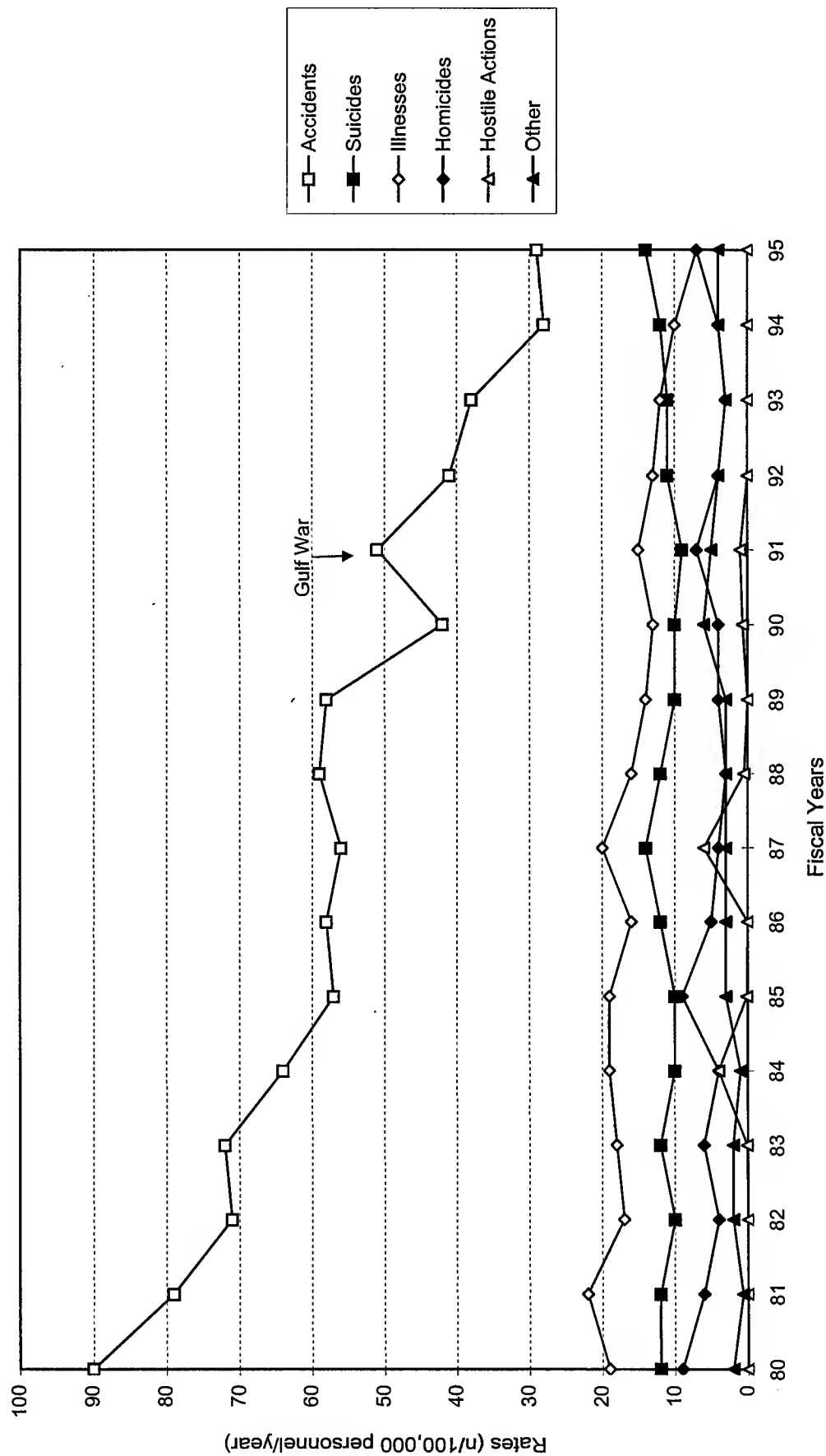
In spite of a drastic decrease in the rate of accidental deaths, the rate for accidents was still greater than any other cause.

Worksheet Data for Figure 2-16

Worksheet Data for Figure 2-10																	
Casualty Types (Rank Based on 1995 Data)		Navy - Rates of Death by Fiscal Year*															
		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Accidents		90	79	71	72	64	57	58	56	59	58	42	51	41	38	28	29
Suicides		12	12	10	12	10	10	12	14	12	10	10	9	11	11	12	14
Illnesses		19	22	17	18	19	19	16	20	16	14	13	15	13	12	10	7
Homicides		9	6	4	6	4	9	5	4	3	4	4	7	4	3	4	7
Hostile Actions		0	0	0	0.1	4	0.1	0	6	0.5	0	0.7	1	0	0	0	0
Other		2	0.7	2	2	1	3	3	3	3	3	6	5	4	3	4	4

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Navy - Rates of Death by Casualty Type for Active Duty Personnel, FY 1980-1995



Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 2-16

2-9. Marine Corps

The Marine Corps casualty data for active duty personnel are presented in three parts:

- The Marine Corps Summary. The Marine Corps casualty data presented in this section are summarized in two tables.
 - The overall summary is presented in Table 2-8.
 - The data in figures 2-17, 2-18, and 2-20 are summarized in Table 2-9.
- Magnitude of the Injury Problem Relative to Other Causes of Death.
 - The distribution of deaths by casualty type for FY 1994 are displayed in Figure 2-17.
 - The distribution of deaths by specific causes for CY 1994 are displayed in Figure 2-18.
- Trends of Military Injury-Related Deaths Relative to Other Causes Over Time.
 - The overall rates of death for FY 1980-1995 are displayed in Figure 2-19.
 - The rates of death by casualty type for FY 1980-1995 are displayed in Figure 2-20.

The Marine Corps Summary.

Table 2-8. Overall Summary of Marine Corps Casualty (Fatality) Data for Active Duty Personnel

Table 2-8. Overall Summary of Marine Corps Casualty (Fatality) Data for Active Duty Personnel							
Year	Total Marine Corps Population	Deaths		Rates and Trends of Deaths			Conclusion
		Total	n/100,000 Personnel/Year	n/100,000 Personnel/Year	Trend, % Change (FY 1980-1995)		
FY80-95	—	—	—	153 (FY80)	81 (FY95)	Down 47%	Overall deaths decreased substantially, primarily due to decreases in accidental deaths.
FY94	174,158	120	69	—	—	—	
CY94	180,819	128	71	—	—	—	

Table 2-9. Summary of Marine Corps Casualty (Fatality) Data for Active Duty Personnel by Type of Casualty—Distribution, Rates, and Trends of Deaths

Casualty Types		Distribution (%) of Deaths		Rates and Trends of Deaths			Conclusions
		FY 1994 (n = 174,158)	CY 1994 (n = 180,819)	n/100,000 Personnel/Year		Trend, % Change (FY 1980-1995)	
				FY 1980	FY 1995		
Accidents		57%	—	109	50	Down 54%	Distribution of Deaths <ul style="list-style-type: none">Accidental injuries, suicides, and homicides account for 86% of all deaths. Accidents <ul style="list-style-type: none">Accidental injuries are the leading cause of death, although accident rates have declined.Accidents occurred nearly 3 times as often as suicides, the second leading cause of death. Illnesses <ul style="list-style-type: none">Illnesses account for less than 15% of all deaths. Homicides <ul style="list-style-type: none">Homicides account for less than 10% of all deaths. Vehicle Accidents <ul style="list-style-type: none">Vehicle accidents occurred two times as often as deaths by gunshot, the second leading specific cause of death.
Suicides		20%	—	15	14	Down 7%	
Illnesses		13%	—	11	2	Down 82%	
Homicides		9%	—	16	5	Down 69%	
Other*		1%	—	2	8	Up 300%	
Top Five Specific Causes of Death							
Vehicle Accidents		—	41%	—	—	—	
Gunshots		—	20%	—	—	—	
Heart Attacks		—	6%	—	—	—	
Aircraft landings		—	6%	—	—	—	
Drownings		—	4%	—	—	—	

* Deaths that have a pending or undetermined cause.

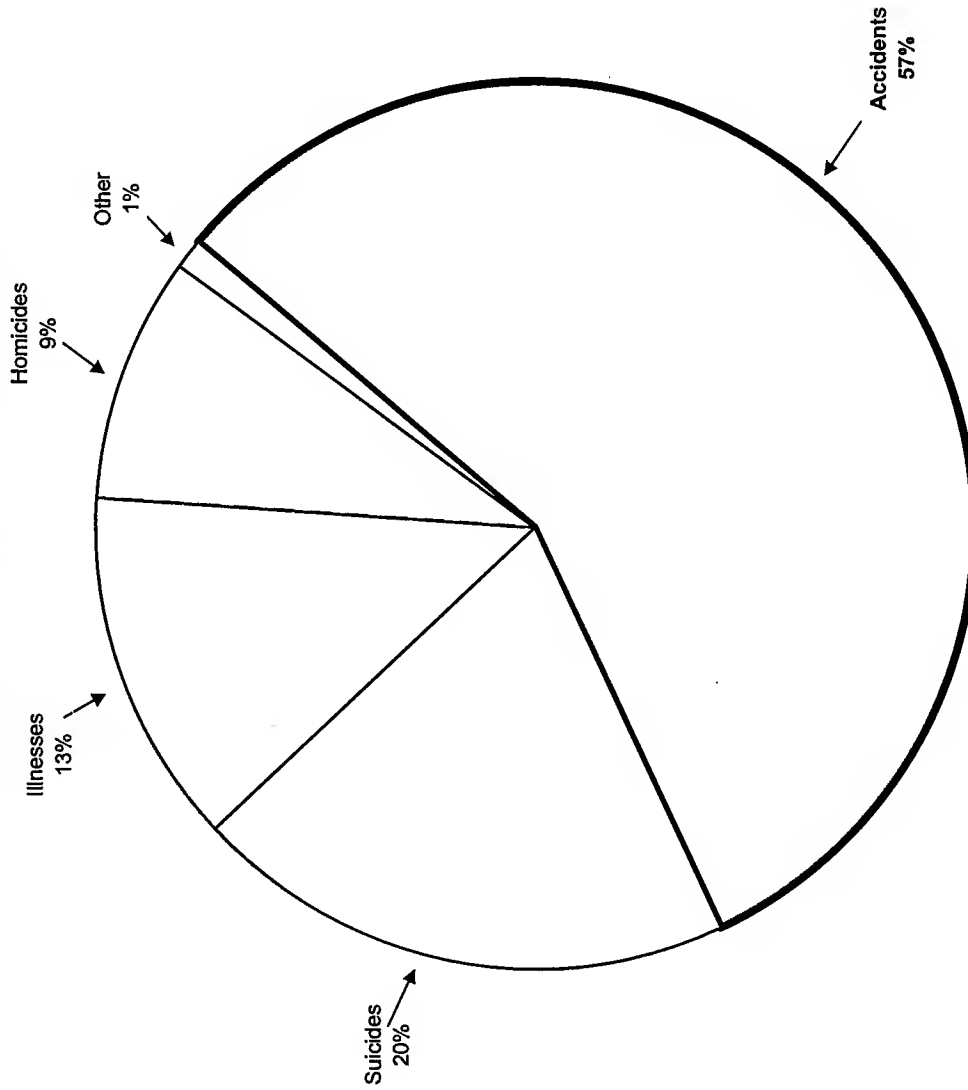
Magnitude of the Injury Problem Relative to Other Causes of Death.

Figure 2-17 illustrates the distribution of deaths by casualty type for active duty Marine Corps personnel for FY 1994:

- Accidents—57%.
- Suicides—20%.
- Illnesses—13%.
- Homicides—9%.
- Other (deaths that have a pending or undetermined cause)—1%.

Accidents, the leading cause of death, occur more than two and a half times as often as suicides, the second leading cause of death. The total number of deaths for FY 1994 was 120 out of a population of 174,158, or 69 deaths per 100,000 personnel.

Marine Corps - Distribution (%) of Deaths by Casualty Type for Active Duty Personnel, FY 1994



n (deaths) = 120.
 population = 174,158.
 * Deaths that have a pending or undetermined cause.

Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

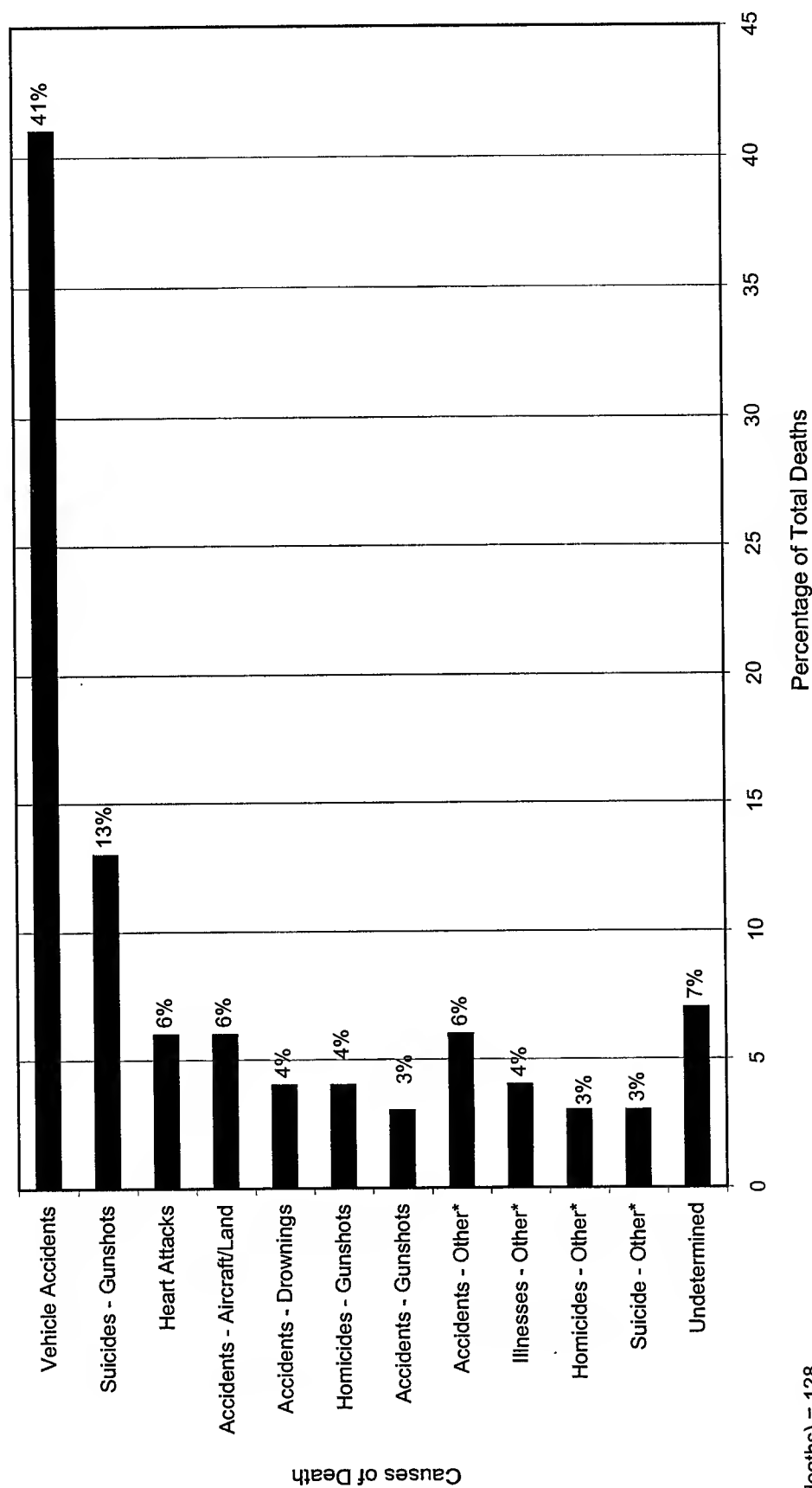
Figure 2-17

Figure 2-18 illustrates the distribution of deaths by more specific causes for active duty Marine Corps personnel for CY 1994. The top five specific causes of death were:

- Vehicle accidents—41%.
- Gunshots—20% (suicides—13%, homicides—4%, and accidents—3%).
- Heart attacks—6%.
- Aircraft landings—6%.
- Drownings—4%.

Vehicle accidents, the leading specific cause of death, occurs more than two times as often as deaths by gunshot, the second leading specific cause of death. The total number of deaths for CY 1994 was 128 out of a population of 180,819, or 71 deaths per 100,000 personnel.

Marine Corps - Distribution (%) of Deaths by Specific Cause for Active Duty Personnel, CY 1994



n (deaths) = 128.
population = 180,819.
* Includes causes accounting for only 1 or 2 deaths.

Source: Worldwide Casualty System Database, as reported to the DoD Injury Surveillance and Prevention Work Group and previously presented in the Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

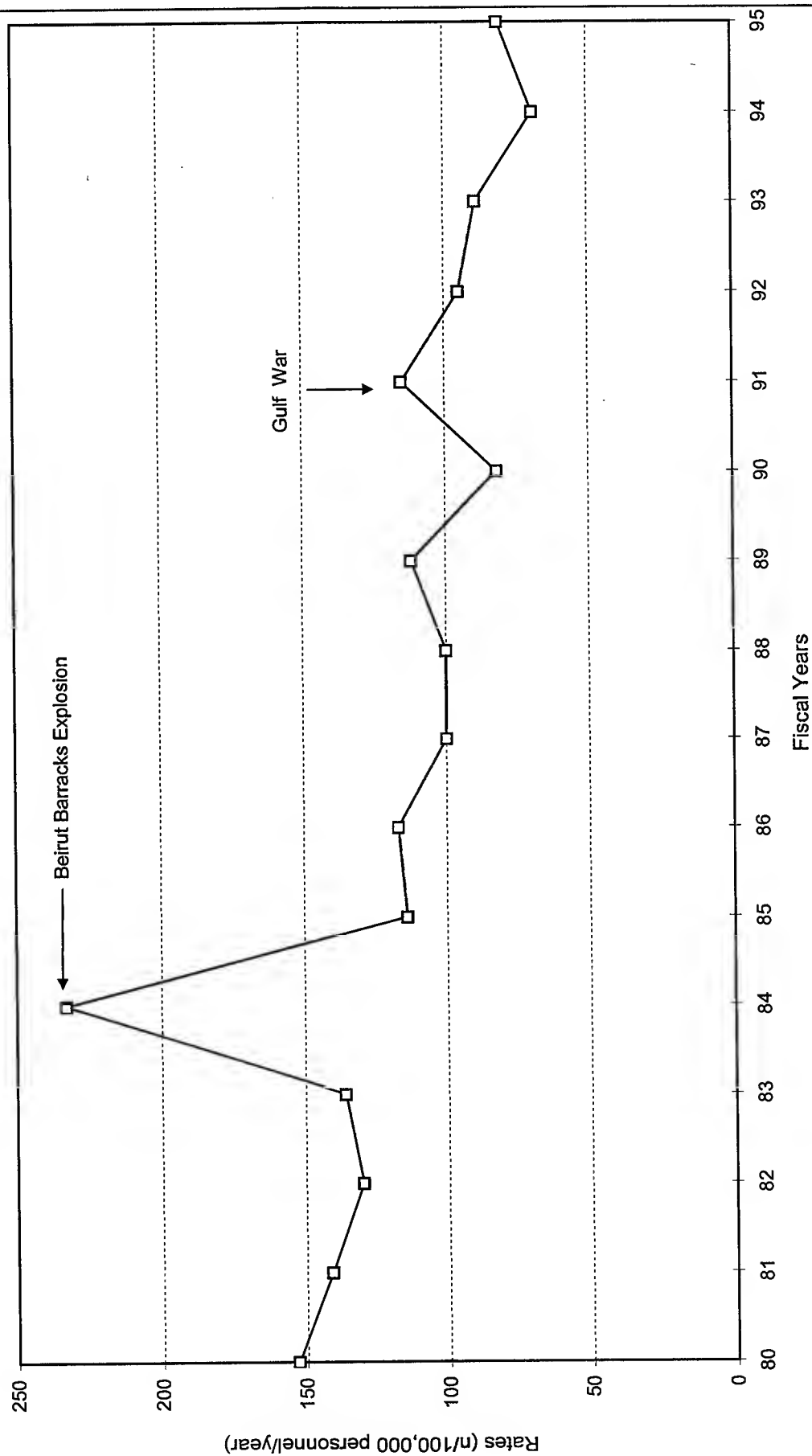
Figure 2-18

Figure 2-19 illustrates the overall rates of death for active duty Marine Corps personnel for FY 1980-1995. Casualties decreased 47% from 153 per 100,000 personnel in FY 1980 to 81 per 100,000 personnel in FY 1995.

Marine Corps - Rates of Death by Fiscal Year*																
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
153	141	130	136	233	114	117	100	100	112	82	115	95	89	69	81	

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Marine Corps - Overall Rates of Death for Active Duty Personnel, FY 1980-1995



Source: Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 2-19

Figure 2-20 illustrates the rates of death by casualty type for active duty Marine Corps personnel for FY 1980-1995.

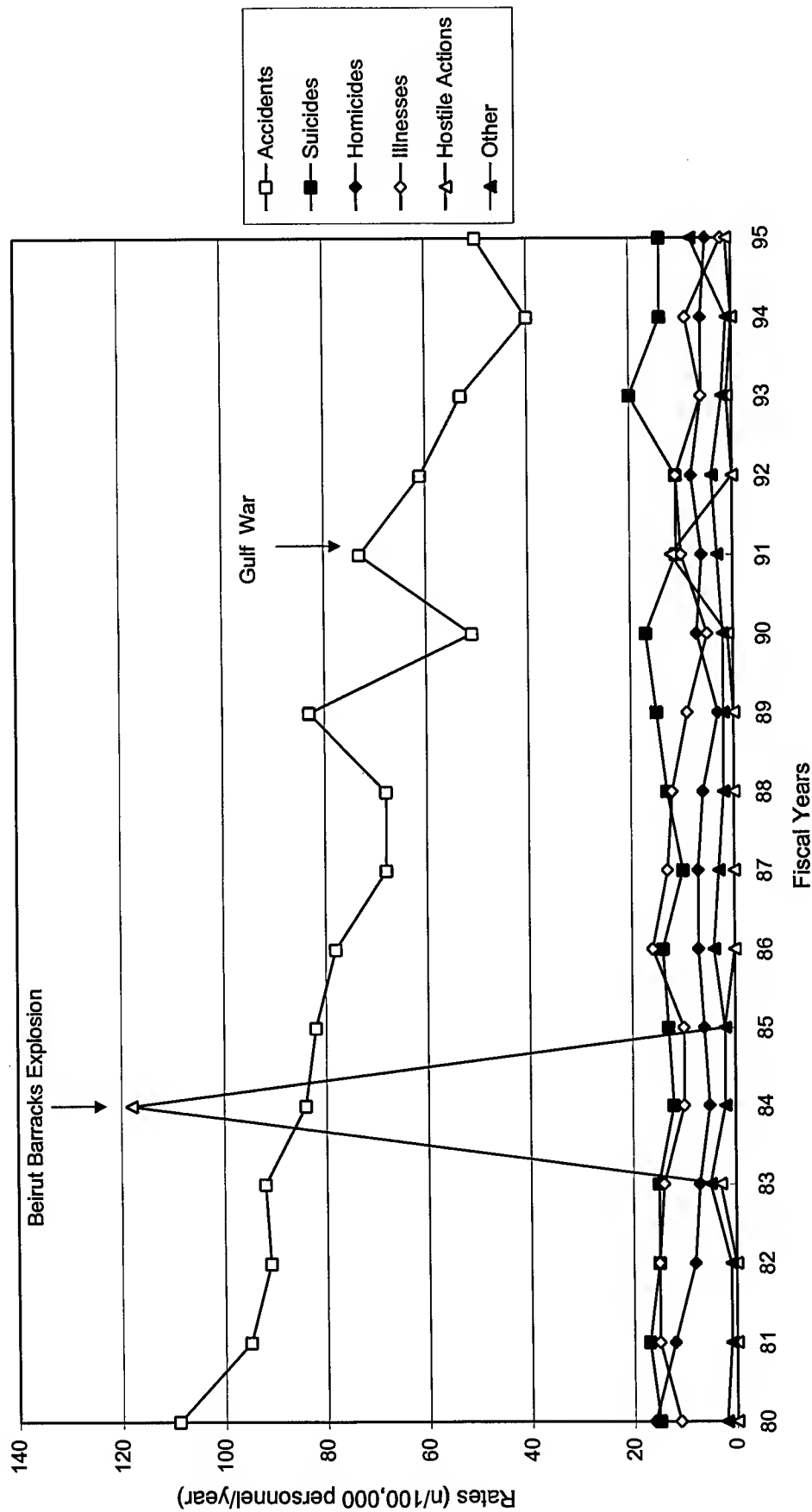
- Accident casualty rates decreased 54% from 109 per 100,000 personnel in FY 1980 to 50 per 100,000 in FY 1995.
- Homicide casualty rates decreased 69% from 16 per 100,000 personnel in FY 1980 to 5 per 100,000 personnel in FY 1995.
- Illness casualty rates decreased 82% from about 11 per 100,000 personnel in FY 1980 to 2 per 100,000 personnel in FY 1995.

Worksheet Data for Figure 2-20

Casualty Types (Rank Based on 1995 Data)		Marine Corps - Rates of Death by Fiscal Year*															
		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Accidents		109	95	91	92	84	82	78	68	68	83	51	73	61	53	40	50
Suicides		15	17	15	15	12	13	14	10	13	15	17	11	11	20	14	14
Homicides		16	12	8	7	5	6	7	7	6	3	7	6	8	6	6	5
Illnesses		11	15	15	14	10	10	16	13	12	9	5	10	11	6	9	2
Hostile Actions		0	0	0	3	118	2	0	0	0	0	1	12	0	1	0	1
Other		2	1	1	5	2	2	4	3	2	2	2	3	4	2	1	8

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Marine Corps - Rates of Death by Casualty Type for Active Duty Personnel, FY 1980-1995



Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# D10R/M07-96/01).

Figure 2-20

2-10. Air Force

The Air Force casualty data for active duty personnel are presented in three parts:

- The Air Force Summary. The Air Force casualty data presented in this section are summarized in two tables.
 - The overall summary is presented in Table 2-10.
 - The data in figures 2-21, 2-22, and 2-24 are summarized in Table 2-11.
- Magnitude of the Injury Problem Relative to Other Causes of Death.
 - The distribution of deaths by casualty type for FY 1994 are displayed in Figure 2-21.
 - The distribution of deaths by specific causes for CY 1994 are displayed in Figure 2-22.
- Trends of Military Injury-Related Deaths Relative to Other Causes Over Time.
 - The overall rates of death for FY 1980-1995 are displayed in Figure 2-23.
 - The rates of death by casualty type for FY 1980-1995 are displayed in Figure 2-24.

The Air Force Summary.

Table 2-10. Overall Summary of Air Force Casualty (Fatality) Data for Active Duty Personnel

Year	Total Air Force Population	Deaths		Rates and Trends of Deaths		Conclusion
		Total	n/100,000 Personnel/Year	n/100,000 Personnel/Year	Trend, % Change (FY 1980-1995)	
FY80-95	—	—	—	93 (FY80)	Down 44%	Overall deaths decreased substantially, due primarily to decreases in accidental deaths.
FY94	426,327	222	52	—	—	
CY94	412,523	227	55	—	—	

Table 2-11. Summary of Air Force Casualty (Fatality) Data for Active Duty Personnel by Type of Casualty—Distribution, Rates, and Trends of Deaths

Casualty Types	Distribution (%) of Deaths		Rates and Trends of Deaths			Conclusions
	FY 1994 (n = 426,327)	CY 1994 (n = 412,523)	n/100,000 Personnel/Year		Trend, % Change	
Accidents	47%	—	58 (FY80) 24 (FY94)	24 (FY94) 34 (FY95)	Down 59% Up 42%	Distribution of Deaths <ul style="list-style-type: none">Accidental injuries, suicides, and homicides account for 77% of all deaths.
Suicides	26%	—	11 (FY80)	16 (FY95)	Up 45%	Accidents <ul style="list-style-type: none">Accidental injuries are the leading cause of death, although accident rates have declined.Accidents occurred almost twice as often as suicides, the second leading cause of death.
Illnesses	21%	—	20 (FY80)	8 (FY95)	Down 60%	Illnesses <ul style="list-style-type: none">Illnesses account for less than one quarter of all deaths.
Homicides	4%	—	4 (FY80)	2 (FY95)	Down 50%	Homicides <ul style="list-style-type: none">Homicide rates are very low, accounting for only 4% of all deaths.
Other*	2%	—	—	—	—	Vehicle Accidents <ul style="list-style-type: none">Vehicle accidents, the leading specific cause of death, occurred only slightly more often than suicides, the second leading specific cause of death.
Top Five Specific Causes of Death						
Vehicle accidents†	—	31%	—	—	—	
Suicides	—	30%	—	—	—	
Heart attacks	—	12%	—	—	—	
GOV aircraft accidents	—	9%	—	—	—	
Other illnesses (not heart attacks)	—	5%	—	—	—	

* Deaths that have a pending or undetermined cause.

† Vehicle accidents become the leading specific cause of accidents (31%) when you combine POV accidents (23%), POV motorcycles (5%), POV others (1%), POV pedestrian (1%), and POV aircraft (1%).

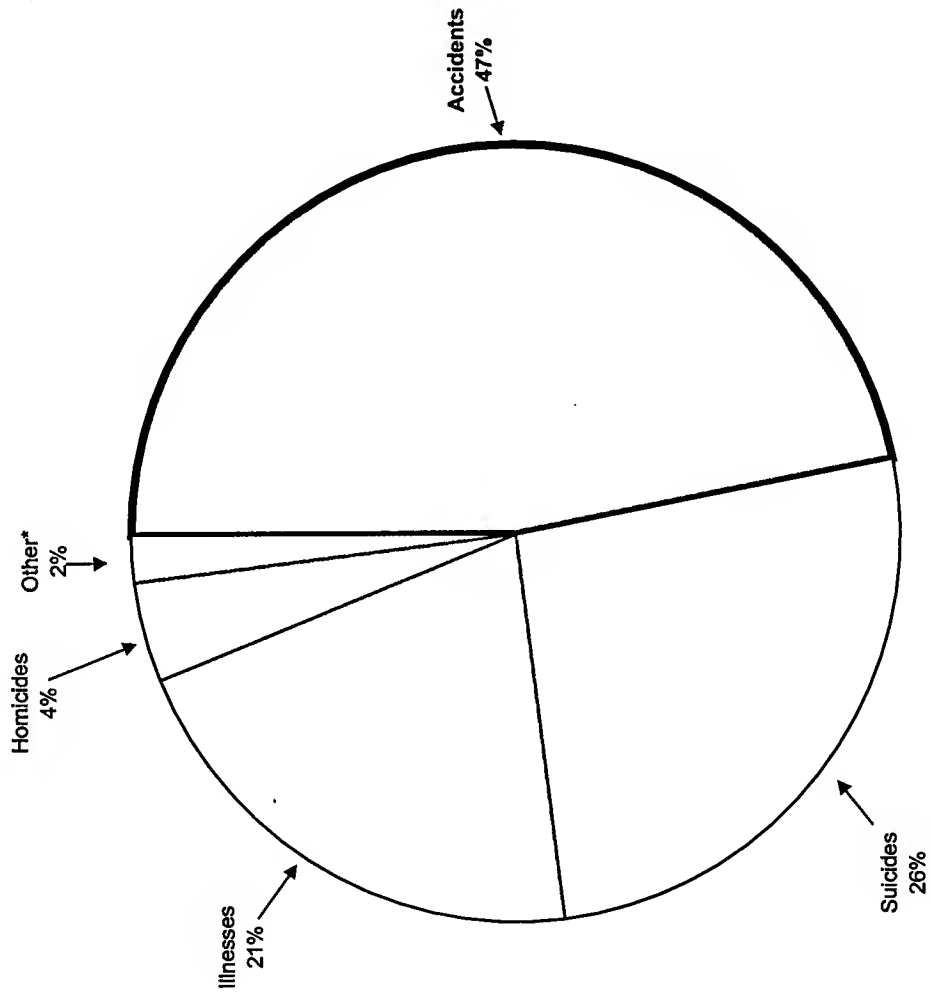
Magnitude of the Injury Problem Relative to Other Causes of Death.

Figure 2-21 illustrates the distribution of deaths by casualty type for active duty Air Force personnel for FY 1994:

- Accidents—47%.
- Suicides—26%.
- Illnesses—21%.
- Homicides—4%.
- Other (deaths that have a pending or undetermined cause)—2%.

Accidents, the leading cause of death, occur almost twice as often as suicides, the second leading cause of death. The total number of deaths for FY 1994 was 222 out of a population of 426,327, or 52 deaths per 100,000 personnel.

Air Force - Distribution (%) of Deaths by Casualty Type for Active Duty Personnel, FY 1994



n (deaths) = 222.
population = 426,327.
* Deaths that have a pending or undetermined cause.

Figure 2-21

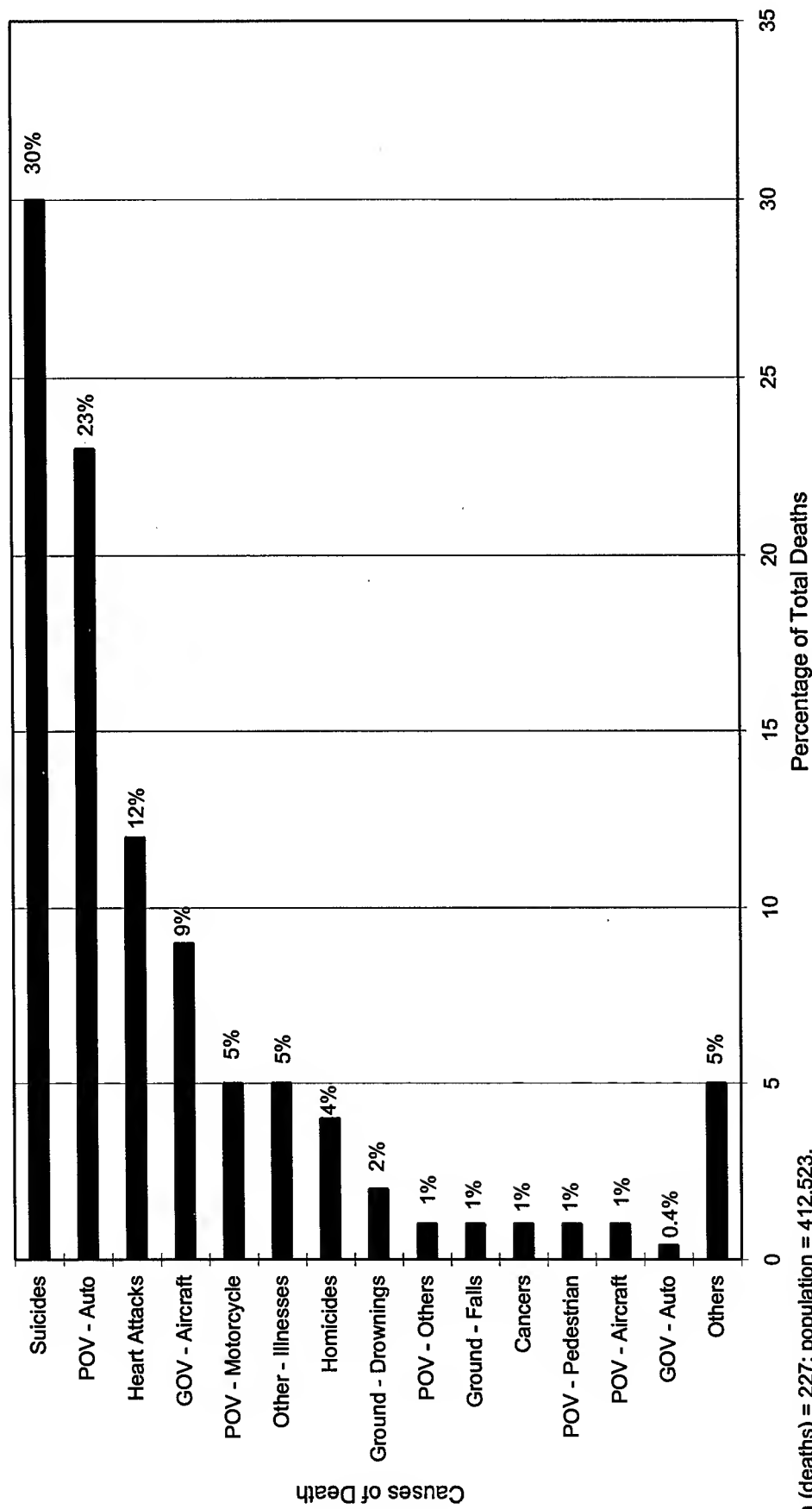
Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 2-22 illustrates the distribution of deaths by specific cause for active duty Air Force personnel for CY 1994. The top five specific causes of death were:

- Suicides—30%.
- POV-auto accidents—23%.
- Heart attacks—12%.
- GOV aircraft accidents—9%.
- POV motorcycle accidents—5%.

Suicides, the leading specific cause of death, occur one and a quarter times as often as deaths by POVs, the second leading specific cause of death. The total number of deaths for CY 1994 was 227 out of a population of 412,523, or 55 deaths per 100,000 personnel.

Air Force - Distribution (%) of Deaths by Specific Cause for Active Duty Personnel, CY 1994



n (deaths) = 227; population = 412,523.

POV = privately owned vehicle.

GOV = government owned vehicle.

Source: U.S. Air Force Armstrong Labs/Aerospace Medicine Directorate, Program and Operations Division (AL/AOP), 1995, as reported to the DoD Injury Surveillance and Prevention Work Group and previously presented in the Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 2-22

Trends of Military Injury-Related Deaths Relative to Other Causes Over Time.

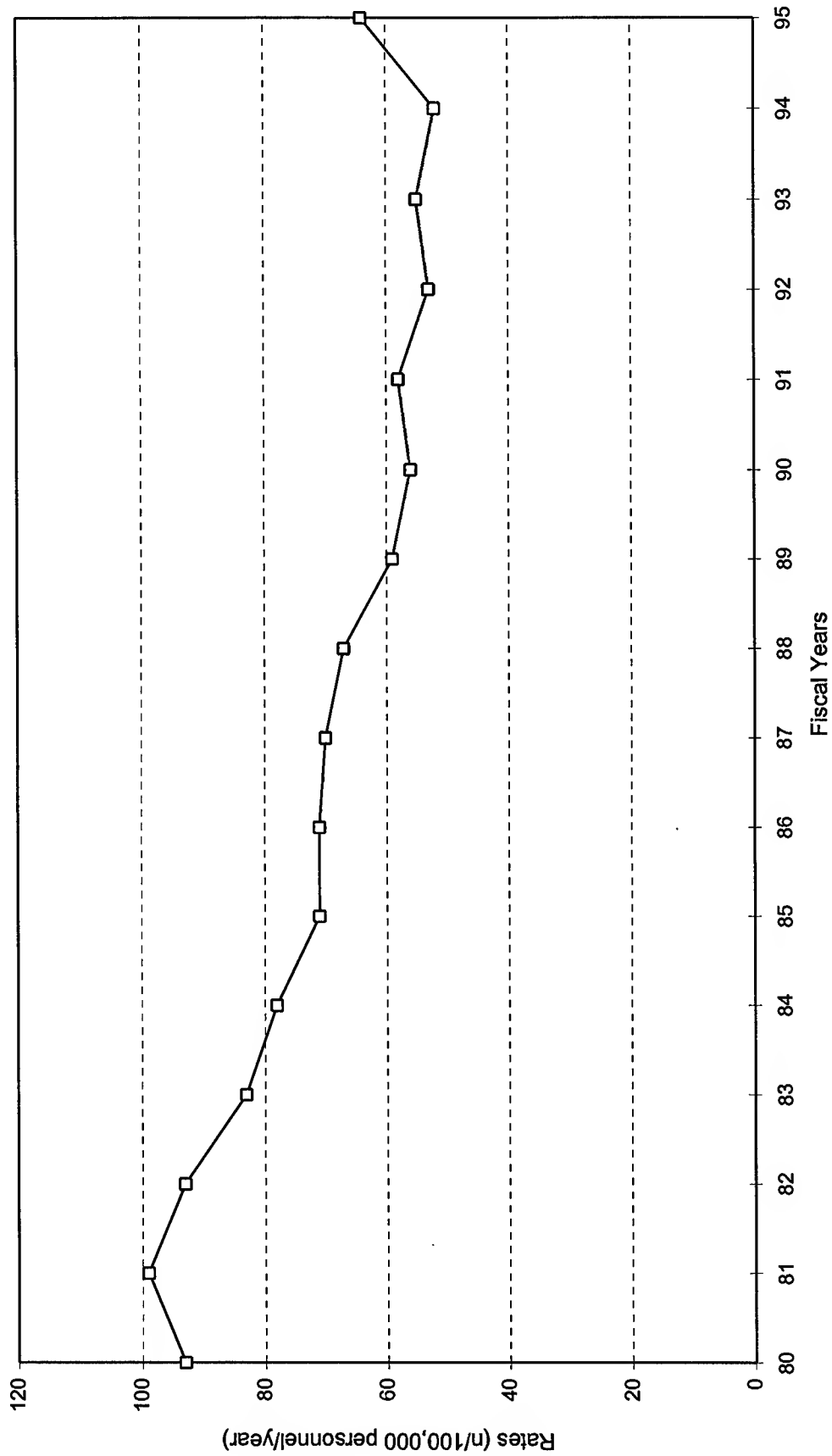
Figure 2-23 illustrates the overall rates of death for active duty Air Force personnel for FY 1980-1995. Casualties decreased 44% from 93 per 100,000 personnel in FY 1980 to 52 per 100,000 personnel in FY 1994, followed by a 23% rise to 64 per 100,000 personnel in FY 1995.

Worksheet Data for Figure 2-23

Air Force - Rates of Death by Fiscal Year*														
1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1995
93	99	93	83	78	71	71	70	67	59	56	58	53	55	64

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Air Force - Overall Rates of Death for Active Duty Personnel, FY 1980-1995



Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIORM07-96/01).

Figure 2-23

Figure 2-24 illustrates the rates of death by casualty type for active duty Air Force personnel for FY 1980-1995.

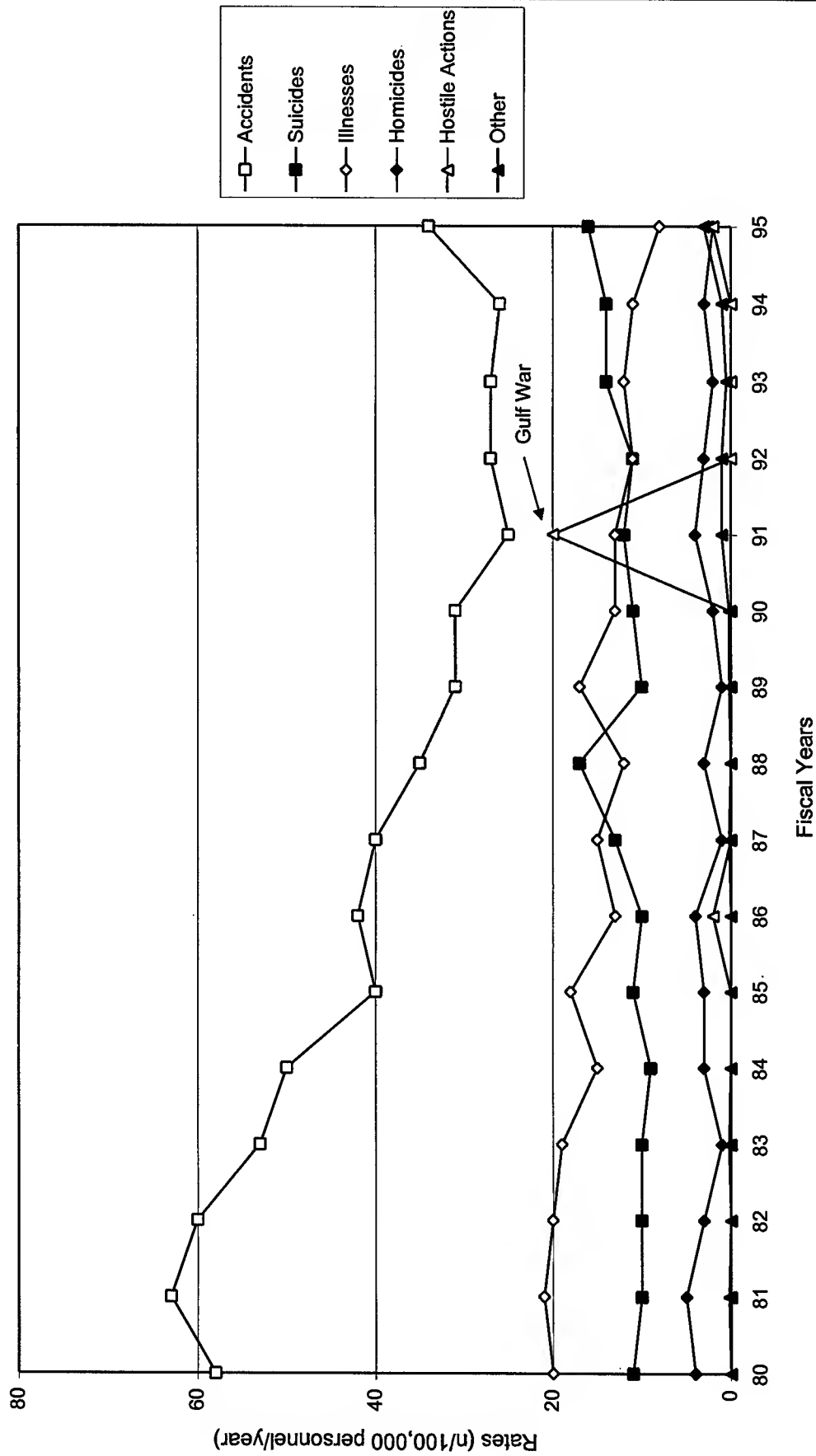
- Accident casualty rates decreased almost 60% from 58 per 100,000 personnel in FY 1980 to 26 per 100,000 personnel in FY 1994, followed by a 42% rise to about 34 per 100,000 personnel in FY 1995. This rate increase in the last reportable year accounts for the observed increase in overall death rates noted in Figure 2-23.
- Suicide casualty rates increased 45% from 11 per 100,000 personnel in FY 1980 to 16 per 100,000 personnel in FY 1995.
- Illness casualty rates decreased 60% from 20 per 100,000 personnel in FY 1980 to 8 per 100,000 personnel in FY 1995.

Worksheet Data for Figure 2-24

Casualty Types		Air Force - Rates of Death by Fiscal Year*															
		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Accidents		58	63	60	53	50	40	42	40	35	31	31	25	27	27	26	34
Suicides		11	10	10	10	9	11	10	13	17	10	11	12	11	14	14	16
Illnesses		20	21	20	19	15	18	13	15	12	17	13	13	11	12	11	8
Homicides		4	5	3	1	3	3	4	1	3	1	2	4	3	2	3	2
Hostile Actions		0	0	0	0	0	0	2	0	0	0	0	20	0	0	0	2
Other		0	0.2	0	0.2	0	0	0	0.2	0	0.2	0.2	1	1	0.5	1	3

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Air Force - Rates of Death by Casualty Type for Active Duty Personnel, FY 1980-1995



Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 2-24

2-11. Comparison of All Services

The service casualty data for each service, presented in paragraphs 2-7 through 2-10, are compared and presented from three perspectives.

- **Table 2-12** compares each service's FY 1994 distribution (%) of deaths for active duty personnel by casualty type.
- **Table 2-13** compares each service's FY 1980-1995 rates and trends of deaths per 100,000 active duty personnel by casualty type.
- **Table 2-14** compares each service's CY 1994 distribution (%) of top five causes of death for active duty personnel by cause specific category.

Table 2-12. Distribution (%) of Deaths for Active Duty Personnel for FY 1994—A Comparison of All Services

Casualty Types	Army	Navy	Marine Corps	Air Force	Conclusions
Accidents	49%	48%	57%	47%	Distribution of Deaths <ul style="list-style-type: none"> • Overall distributions as a percentage of total deaths are similar for all services. • At least three quarters of all deaths in each of the services were due to injuries (when unintentional and intentional injuries are combined). Accidents <ul style="list-style-type: none"> • Accidental injury deaths, as a percentage of total deaths, are similar for the Army, Navy, and Air Force, but are about 20% higher for the Marine Corps.
Suicides	18%	20%	20%	26%	
Illnesses	20%	18%	13%	21%	
Homicides	9%	8%	9%	4%	
Hostile Actions	4%	0%	0%	0%	Suicides <ul style="list-style-type: none"> • The Air Force has 25% more suicides than the other services. Homicides <ul style="list-style-type: none"> • The Air Force has one half the homicide rates of the other services.
Other*	<1%	6%	1%	2%	

* Deaths that have a pending or undetermined cause.

Table 2-13. Rates and Trends of Deaths Per 100,000 Active Duty Personnel Per Year for FY 1980-1995—A Comparison of All Services

Casualty Types	Army	Navy	Marine Corps	Air Force	Conclusions
Accidents FY 1980 FY 1995 % Change	74 40 Down 46%	90 29 Down 68%	109 50 Down 54%	58 34 Down 41%	Death Rates • Death rates from accidental injury, homicide, and illness have declined steadily since FY 1980. Accidents • Accidental injury trends are downward and influence overall downward trends for all deaths. Suicides and Homicides • Violent injuries (suicides and homicides combined) are the second leading cause of death in recent years. Hostile Actions • Over the last 15 years, hostile actions are a small contribution to total deaths.
Suicides FY 1980 FY 1995 % Change	11 14 Up 27%	12 14 Up 17%	15 14 Down 7%	11 16 Up 45%	
Illnesses FY 1980 FY 1995 % Change	21 17 Down 19%	19 7 Down 63%	11 2 Down 82%	20 8 Down 60%	
Homicides FY 1980 FY 1995 % Change	8 4 Down 50%	9 7 Down 22%	16 5 Down 69%	4 2 Down 50%	
Hostile Actions FY 1980 FY 1995 % Change	.12 .39 †	0 0 0	0 † †	0 † †	
Other* FY 1980 FY 1995 % Change	† † †	2 4 Up 100%	2 8 Up 300%	0 3 †	

* Deaths that have a pending or undetermined cause.

† Insignificant; absolute numbers are small.

Table 2-14. Distribution (%) of Top Five Causes of Death* for Active Duty Personnel for CY 1994—A Comparison of All Services

Table 2-14. Distribution (%) of Top Five Causes of Death for Active Duty Personnel for FY 1994 (Comparison with FY 1993)											
Cause-Specific Categories	Top Five Causes of Death Per Service										Conclusions
	Army		Navy		Marine Corps		Air Force				
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	
Vehicle Accidents	32%	1	32%	1	41%	1	31%†	1			Vehicle Accidents • Vehicle accidents are the number one cause of death for all services. Heart Attacks • Heart attacks are the third leading cause of death for all services. Gunshots • Deaths by gunshot are the second leading cause of death for all services except the Air Force.
Gunshots	21%	2	19%	2	20%	2					
Heart Attacks	10%	3	12%	3	6%	3	12%	3			
Suicides	—	—	—	—	—	—	30%	2			
Fires and Burns	5%	4	—	—	—	—					
Training-Related Accidents	5%	5	—	—	—	—					
Drownings	—	—	3%	5	4%	5					
Aircraft Accidents at Sea/Aircraft Landings	—	—	5%	4	6%	4					
GOV Aircraft Accidents	—	—	—	—	—	—	9%	4			
Other Illnesses (Not Heart Attacks)	—	—	—	—	—	—	5%	5			

* As reported; methods of categorizing may differ among the services.

† All vehicle crashes, private and military, are combined.

CHAPTER 3

FATAL AND NONFATAL ACCIDENTS/MISHAPS: SAFETY CENTER DATA

William H. Wortley, Gene Feierstein, Albert Lillibridge, Robert Parli, Guy Mangus, and John F. Seibert, CIH

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Section I. Description of the Military Services Safety Center Databases

3-1. Introduction

Each military service has a safety center that maintains an accident/mishap database on active duty, Reserve, and National Guard populations. The term accident is used by the Army and appears throughout the Army section of this chapter; the term mishap is used by the Navy, Marine Corps, and Air Force and appears throughout the Navy, Marine Corps, and Air Force sections of this chapter. Although the terms are different, both accident and mishap have the same intended meaning: an unplanned event or series of events that causes injury or occupational illness.

- An *injury* is a traumatic wound or other condition of the body caused by external force, including stress or strain. The injury is (1) identifiable as to time and place of occurrence and member or function of the body affected, and (2) caused by a specific event or incident or series of events or incidents within a single day or work shift.
- An *occupational illness* is a nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposure to conditions of the work environment over a long period of time. For practical purposes, an occupational illness is any reported condition that does not meet the definition of injury.

3-2. Mission

Each military service safety center:

- Collects, maintains, analyzes, and reports injury and illness data, as well as other accidents/mishaps affecting military personnel.
- Ensures that effective corrective action is taken on identified accident/mishap causal factors.

- Ensures that historical safety data (lessons learned) are considered and used during the development and acquisition of new systems.
- Upon request, furnishes to the Deputy Under Secretary of Defense (Environmental Security) information that may be required to evaluate DoD component programs and develop DoD special emphasis programs.
- Forwards information relative to serious accident/mishap reports.

3-3. Purpose of the Safety Databases

The safety databases archive data relating to accidents/mishaps (i.e., *unintentional* injuries and events), which excludes intentional/violent injuries resulting from hostile actions, homicides, and suicides, as well as nonoccupational diseases. Accident/mishap classes presented here are classified as A, B, or C. **Table 3-1** displays these accident/mishap severity classifications relative to total cost of reportable property damage and injury and occupational illness.

Each service uses its own database to document and provide accident/mishap information as required by DoDI 6055.7, including the types of events that must be reported and the appropriate method of estimating the cost of an accident/mishap:

- Army Safety Management Information System (ASMIS).
- Navy Safety Information Management System (SIMS).
- Marine Corps Ground Mishap Information System (GMIS). (Marine Corps aviation mishap data is tracked in SIMS.)
- U.S. Air Force Mishap Information System (AFMIS).

The cumulative data from these safety databases are used to track and compare frequencies and rates of ground and aviation accidents from year to year by each respective service and not through a DoD office. Ground accidents are defined as any accident exclusive of military aviation accidents (e.g., privately owned vehicle); aviation accidents are defined as accidents that involve military flights or are flight related (aircraft engine is running).

Table 3-1. Accident/Mishap Severity Classification

Accident/ Mishap Class	Either Condition May Apply		Definitions
	Total Cost of Reportable Property Damage	Injury/Occupational Illness	
A	<ul style="list-style-type: none"> • \$1M or more, and/or • Aircraft, missile, or spacecraft destroyed 	<ul style="list-style-type: none"> • Fatality or permanent total disability 	<ul style="list-style-type: none"> • <i>Fatality</i> results in death from an accident/mishap or the complications arising therefrom, regardless of length of time between the accident/mishap and a subsequent death. • <i>Permanent total disability</i> is any nonfatal injury or occupational illness that in the opinion of the competent medical authority, permanently and totally incapacitates a person to the extent that he or she cannot follow any gainful occupation. (Note: The loss, or the loss of use of both hands, both feet, both eyes, or a combination of any of these body parts as a result of a single accident/mishap, shall be considered as a permanent total disability.)
B	<ul style="list-style-type: none"> • \$200K or more, but less than \$1M 	<ul style="list-style-type: none"> • Permanent partial disability, or • Five or more people are hospitalized as inpatients 	<ul style="list-style-type: none"> • <i>Permanent partial disability</i> is an injury or occupational illness that does not result in death or permanent total disability but, in the opinion of the competent medical authority, results in permanent impairment through loss or loss of use of any part of the body, with the following exceptions: <ul style="list-style-type: none"> - Loss of teeth. - Loss of fingernails or toenails. - Loss of tips of fingers or tips of toes. - Inguinal hernia, if it is repaired. - Disfigurement. - Sprains or strains that do not cause permanent limitation of motion.
C	<ul style="list-style-type: none"> • \$10K or more, but less than \$200K 	<ul style="list-style-type: none"> • Nonfatal injury resulting in loss of time from work beyond day/shift when injury occurred, or • Nonfatal illness or disability resulting in loss of time from work or disability at any time (lost time case). 	<ul style="list-style-type: none"> • <i>Lost time case</i> is a— <ul style="list-style-type: none"> - Nonfatal traumatic injury that causes loss of time from work beyond the day/shift on which it occurred, or - Nonfatal nontraumatic illness that causes loss of time from work or disability at any time.

Source: DoDI 6055.7, Mishap Investigation, Reporting, and Recordkeeping.

3-4. Authority

All services are governed by the:

- Mishap Investigation, Reporting, and Recordkeeping (DoDI 6055.7).
- Occupational Safety and Health Act of 1970 (Public Law 91-596).
- Occupational Safety and Health for Federal Employees (Executive Order 12196).
- Basic Program Elements for Federal Employee Occupational Safety and Health Programs (29 CFR 1960).

The documents listed below provide guidance for all accident/mishap data collection, organization, and management. Additional requirements for each service are outlined in their own governing instructions, manuals, or orders.

- Army.
 - Accident Reporting and Records (AR 385-40).
 - Army Safety Program (AR 385-10).
 - Army Accident Investigation and Reporting (DA PAM 385-40).
- Navy.
 - Naval Aviation Safety Program (OPNAVINST 3750.6Q).
 - Mishap Investigation and Reporting (OPNAVINST 5102.1C).
 - Navy Occupational Safety and Health Program Manual (OPNAVINST 5100.23C).
 - Navy Occupational Safety and Health Program Manual for Forces Afloat (OPNAVINST 5100.19C).
- Marine Corps.
 - Naval Aviation Safety Program (OPNAVINST 3750.6Q).
 - Marine Corps Ground Mishap Reporting (MCO P5102.1).
 - Marine Corps Occupational Safety and Health Program (MCO 5100.8E).
- Air Force.
 - Safety Program (Policy Directive 91-2).
 - Investigating and Reporting U.S. Air Force Mishaps (Instruction 91-204).

3-5. Comparison of Minimum Basic Data Set Variables and Service Safety Center Databases

Each service identified their database's injury variables for *unintentional injuries* using the questionnaire discussed in Chapter 1 (see pages 1-23 through 1-27). These variables were compared to the MBDS for unintentional injury surveillance recommended by Lund, Holder, and Smith.* A comparison is presented in Table 3-2.

The services were not asked to identify their database's injury variables for *intentional injuries*.† Additional data required to satisfy the MBDS for intentional injuries include circumstances or motive surrounding injury event, drugs or alcohol involved, weapon(s) involved, relationship and demographics of victim and perpetrator, and source of data.

* Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994.

† Powell, K. and J. Kraus. Minimum Basic Data Set, Intentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:35-1 to 35-2, 1994.

Table 3-2. A Comparison of the Recommended Elements for the Minimum Basic Data Set Variables for Unintentional Injury Surveillance and Their Availability from the Service Safety Center Databases

Variables	Army Safety Center	Naval Safety Center		Air Force Safety Center
		Navy	Marine Corps	
Intent*	Y	Y	Y	Y
Age of Injured*	Y	Y	Y	Y
Gender*	Y	Y	Y	Y
Race*	N	N	N	N
Place of Residence*	NS	NS	NS	NS
Date of Injury Event*	Y	Y	Y	Y
Place of Occurrence (home, work, etc.)*	Y	Y	Y	Y
Address of Place of Occurrence*	NS	NS	NS	NS
Activity when Injury Occurred*	Y	Y	Y	Y
Mechanism of Accident/Event*	Y	Y	Y	Y
Type of Injury/Body Location*	Y	Y	Y	Y
Outcome of Injury				
Type of Treatment†	N	N	N	N
Dates of Treatment†	N	N	N	Y
Date Admitted to Hospital†	N	N	N	Y
Date Discharged from Hospital†	N	N	N	N

Table 3-2.—Continued

Variables	Army Safety Center	Naval Safety Center		Air Force Safety Center
		Navy	Marine Corps	
Nature of Disability†	N	N	N	Y
Degree of Disability (fit for duty, TDRL, etc.)†	N	Y	Y	Y
Severity of Injury†	Y	Y	Y	Y
Days of Limited Duty†	Y	N‡	N‡	N
Days in Hospital†	Y	Y	Y	Y
Cost of Treatment†§	Y	Y	Y	Y

Y = available in database.

N = not in database.

NS = not solicited on questionnaire.

* Recommended variables for databases for unintentional injury surveillance (Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994).

† Example of an outcome variable deemed desirable for databases with potential for surveillance of unintentional injuries to U.S. active duty military and civilian personnel.

‡ The Navy and Marine Corps collect data on lost work days.

§ All service safety centers are required to report cost figures per DoDI 6055.7.

Section II. Military Service Safety Center Data

3-6. Army

The Army Safety Center data for Army military personnel are presented in three parts:

- The Army Summary. The Army safety data presented in this section are summarized in three tables.
 - The overall summary is presented in Table 3-3.
 - The data in figures 3-1, 3-2, and 3-4 are summarized in Table 3-4.
 - The data in figures 3-6, 3-7, and 3-12 are summarized in Table 3-5.
- Magnitude of the Injury Problem Relative to Other Causes of Accidents.
 - The distribution of deaths by accident types for FY 1994 is displayed in Figure 3-1.
 - The distribution of Class A-C accidents by types and costs for FY 1994 are displayed in figures 3-2 through 3-4.
- Trends of Army Accidental Deaths and Overall Accidents Relative to Other Causes Over Time.
 - The accident fatality rates and the rates of accidents are displayed in figures 3-5 through 3-12.

The Army Summary.

Table 3-3. Overall Summary of Army Fatality and Class A-C Accident Data for Military Personnel

FY	Total Army Population	Number, Rates, and Trends of Deaths (FY 1990 and 1994)			Number, Rates, and Trends of Class A-C Accidents (FY 1990 and 1994)			Conclusion
		Total	n/100,000 Personnel	Trend, % Change (FY 1990-1994)	Total	n/1,000 Personnel	Trend, % Change (FY 1990-1994)	
1990	732,403	357	49	Down 12%	7,848	11	Down 27%	Both accident rates and accident-related fatality rates declined from FY 1990 to 1994.
1994	541,343	233	43		4,192	8		

Table 3-4. Summary of Army Safety Data by Type of Accident for Military Personnel, FY 1994—Distribution (%) and Costs

Accident Type	Deaths (n=233)		Class A-C* Accidents				Conclusions
	Distribution (%) & Rank Order		Distribution (%) & Rank Order		Distribution (%) by Estimated Cost		
	%	Rank	%	Rank	%	Cost (Million)	
Privately Owned Vehicles	59%	1	17%	2	35%	\$31.85	Privately Owned Vehicles <ul style="list-style-type: none">While 59% of deaths were due to privately owned vehicle accidents, only 17% of Class A-C accidents involved privately owned vehicles. Personnel Injuries <ul style="list-style-type: none">Personnel injuries account for almost 70% of all Class A-C accidents, but only 12% of deaths. Costs <ul style="list-style-type: none">Privately owned vehicles and personnel injuries each account for about one third of all accident costs.
Personnel Injuries	12%	2	68%	1	34%	\$30.94	
Aviation	5%	3	3%	4	12%	\$10.92	
Military Vehicles Motor/Wheeled Combat/Tracked	3%	4	10%	3	3%	\$2.73	
	3%	5			2%	\$1.82	
Other	18%†	—	2%	5	14%	\$12.74	

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

† Includes 37 fatalities from the Pope Air Force Base and Iraq accidents.

Table 3-5. Summary of Army Safety Data by Type of Deaths and Class A-C Accidents for Military Personnel—Rates and Trends

Type	Rates and Trends of Deaths				Class A-C Accident Rates				Conclusions
	n/100,000 Personnel/Year			% Change (FY 1980 - 1994)	n/1,000 Personnel/Year	% Change (FY 1990- 1994)			
	FY80	FY90	FY94						
Personnel Injuries	—	6	4	—	7	4	Down 43%	Death Rates <ul style="list-style-type: none">Deaths due to privately owned vehicle, military vehicle, and aviation/flight accidents declined over the 15-year period. Class A-C Accident Rates <ul style="list-style-type: none">Personnel injury rates declined over the 5-year period.All other accident rates remained relatively constant for the entire 5-year period.	
Privately Owned Vehicles	37	26	21	Down 43%	1	1	No change		
Military Vehicles Motor/Wheeled Combat/Tracked	6 — —	5 4 1	2 1 1	Down 67% — —	.9 — —	.7 — —	No change		
Aviation/Flight	9	2	1	Down 89%	.1	.2	No change		

Magnitude of the Injury Problem Relative to Other Causes of Accidents.

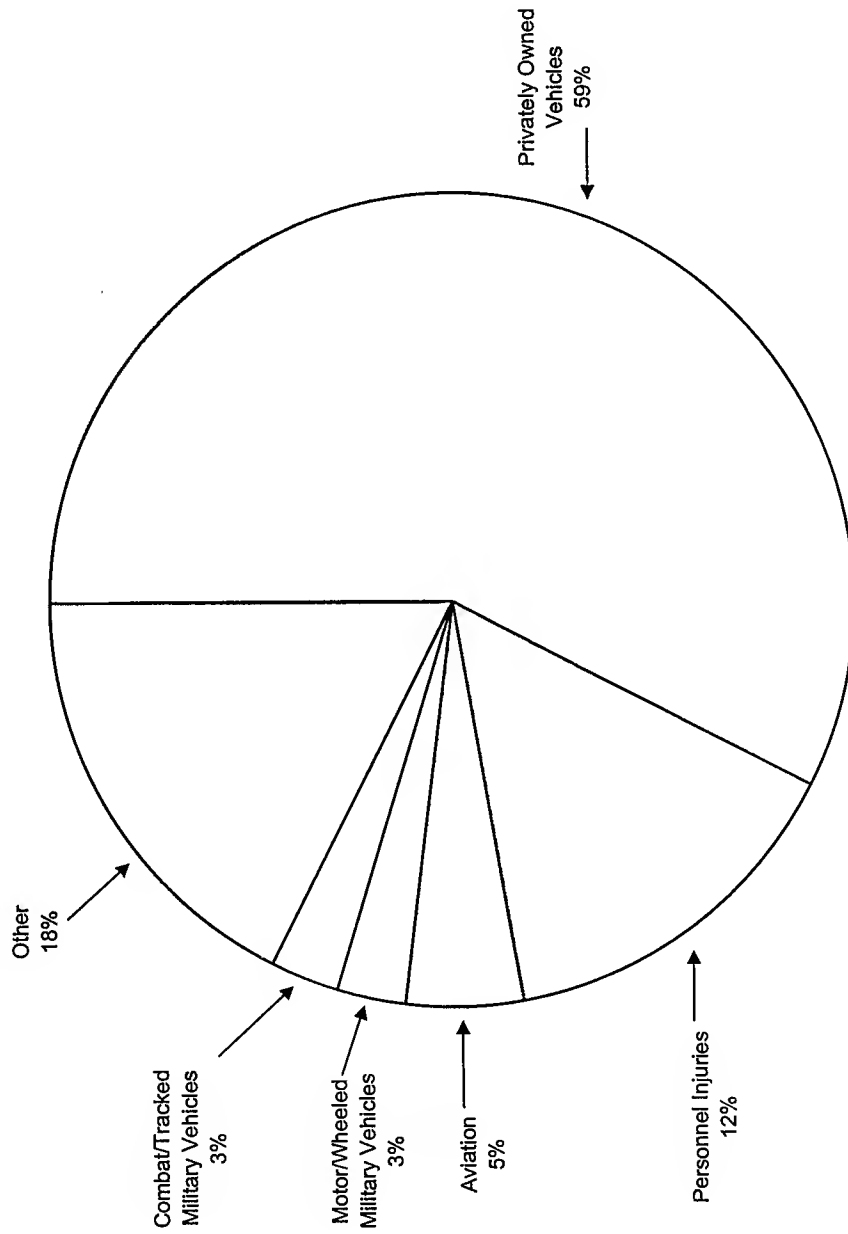
Figure 3-1 illustrates the distribution of deaths by accident type for Army military personnel for FY 1994. The top five types of fatal accidents resulted from:

- Privately owned vehicles—59%.
- Personnel injuries—12%.
- Aviation—5%.
- Motor/wheeled military vehicles—3%.
- Combat/tracked military vehicles—3%.

The “Other” category accounts for 18% of the deaths, which includes 37 fatalities from the Pope Air Force Base and Iraq accidents.

Deaths from privately owned vehicle accidents, the leading cause of death, occur almost five times as often as deaths from personnel injuries, the second leading cause of death. The total number of deaths for FY 1994 was 233 out of a population of 541,343, or 43 deaths per 100,000 personnel per year.

Army - Distribution (%) of Deaths by Accident Type for Military Personnel,* FY 1994



n (deaths) = 233.
 population = 541,343.
 * Data include active duty, Reserve, and National Guard.

Source: U.S. Army Safety Center, Washington, DC, 1995, and personal communication, 1997.

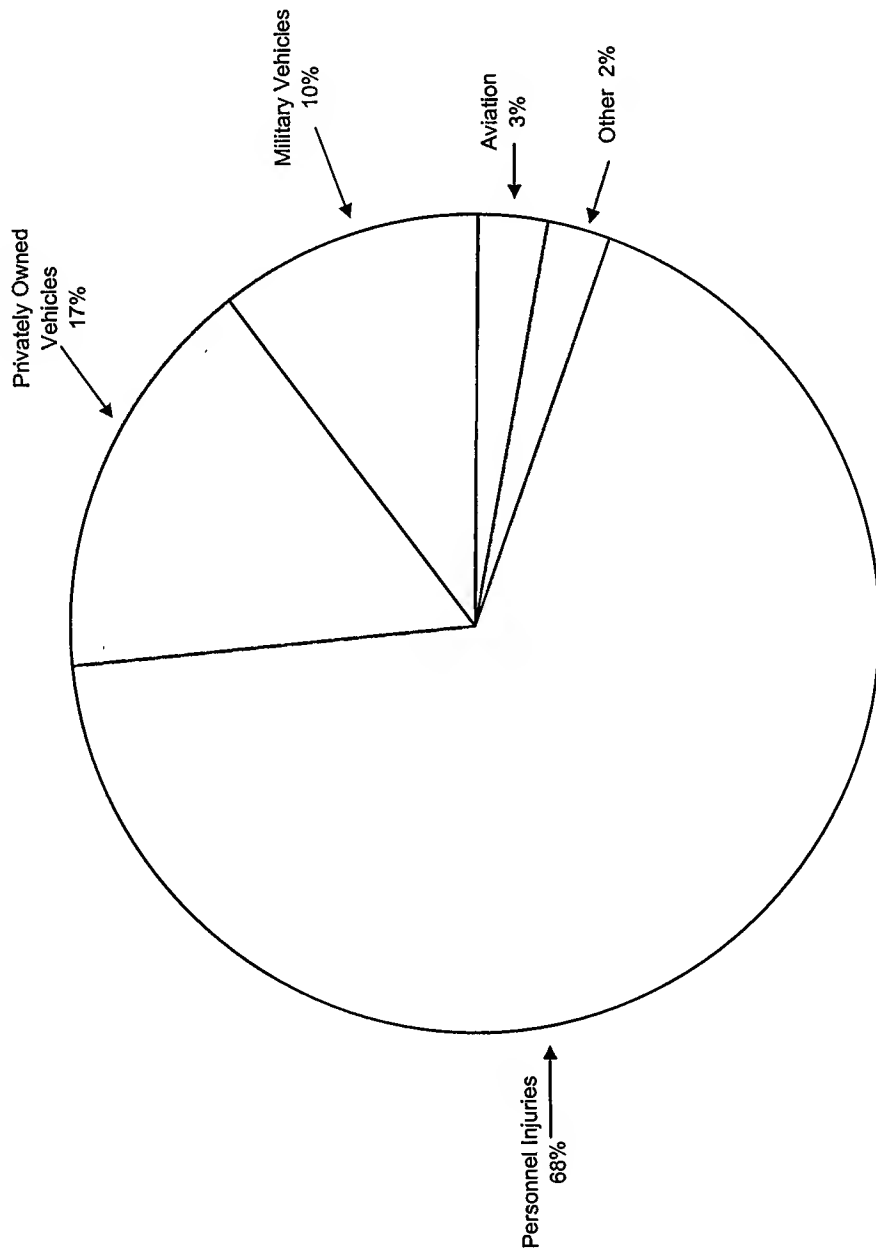
Figure 3-1

Figure 3-2 illustrates the distribution of Class A-C accidents by type for Army military personnel for FY 1994:

- Personnel injuries—68%.
- Privately owned vehicles—17%.
- Military vehicles—10%.
- Aviation—3%.
- Other—2%.

Personnel injuries, the leading cause of accidents, occur four times as often as injuries due to privately owned vehicles, the second leading cause of accidents. The total number of Class A-C accidents for FY 1994 was 4,223 out of a population of 541,343, or 780 reported accidents per 100,000 personnel.

Army - Distribution (%) of Class A-C* Accidents by Type for Military Personnel,† FY 1994



n (accidents) = 4,223.

population = 541,343.

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

† Data include active duty, Reserve, and National Guard.

Source: U.S. Army Safety Center, Washington, DC, 1995, and personal communication, 1997.

Figure 3-2

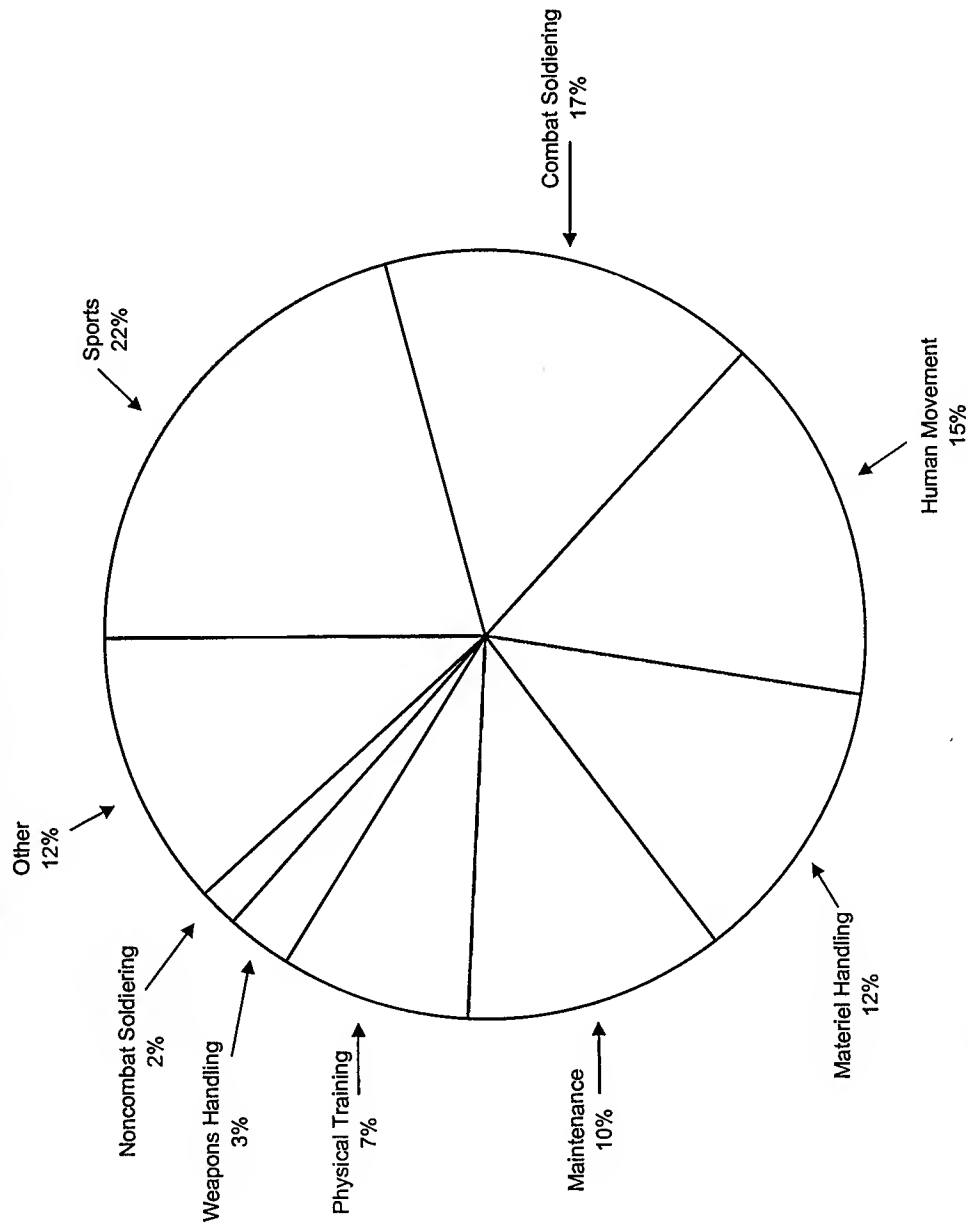
Figure 3-3 illustrates the distribution of Class A-C personnel injury accidents by type for Army military personnel for FY 1994. The top five specific causes of personnel injuries were:

- Sports—22%.
- Combat soldiering—17%.
- Human movement*—15%.
- Materiel handling—12%.
- Maintenance—10%.

The total number of Class A-C personnel injuries for FY 1994 was 2,851 out of a population of 541,343, or 527 personnel injuries per 100,000 personnel.

* Human movement is defined as walking, running, getting in or out of a vehicle, or some type of movement that is not related to another task (for example, vehicle accident or weapons handling).

Army - Distribution (%) of Class A-C* Personnel Injury Accidents by Type for Military Personnel,† FY 1994



n (accidents) = 2,851.
population = 541,343.

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

† Data include active duty, Reserve, and National Guard.

Source: U.S. Army Safety Center, Washington, DC, 1995, and personal communication, 1997.

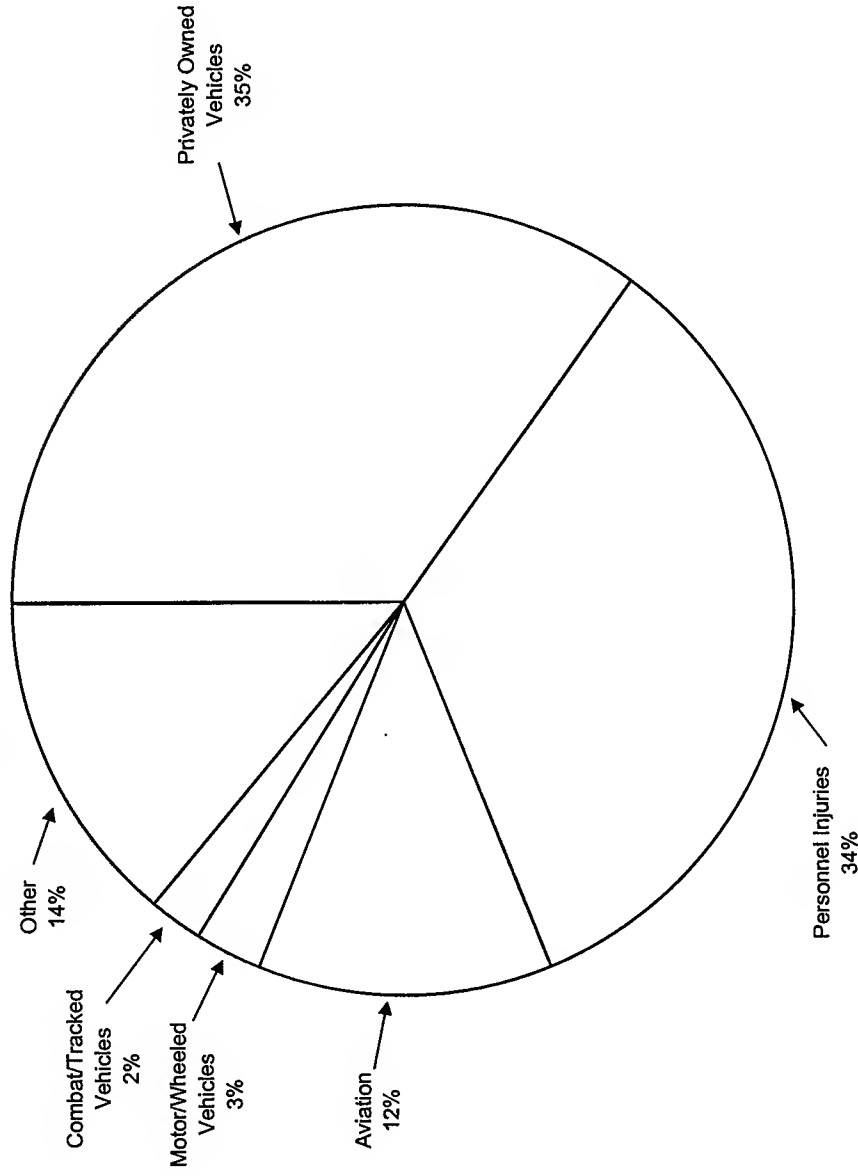
Figure 3-3

Figure 3-4 illustrates the distribution of Class A-C estimated costs of accidents by type for Army military personnel for FY 1994. Army cost estimates are made using DoD rates from DoDI 6055.7. Cost estimates are based on the estimated cost of repair to Army property or the cost of a destroyed Army system, plus the cost of lost days, disability, and death as reported on the Army accident reporting forms. The top five costs of accidents resulted from:

- Privately owned vehicles—35% (\$32 million).
- Personnel injuries—34% (\$31 million).
- Aviation—12% (\$11 million).
- Motor/wheeled vehicles—3% (\$3 million).
- Combat/tracked vehicles—2% (\$2 million).

Other accounts for 14% of the costs, or \$13 million. The total cost of Class A-C accidents for FY 1994 was \$92 million.

Army - Distribution (%) of Class A-C* Estimated Costs of Accidents by Type for Military Personnel,† FY 1994



Total estimated cost = \$92 million.

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

† Data include active duty, Reserve, and National Guard.

Source: U.S. Army Safety Center, Washington, DC, personal communication, April 1997.

Figure 3-4

Trends of Army Accidental Deaths and Overall Accidents Relative to Other Causes Over Time.

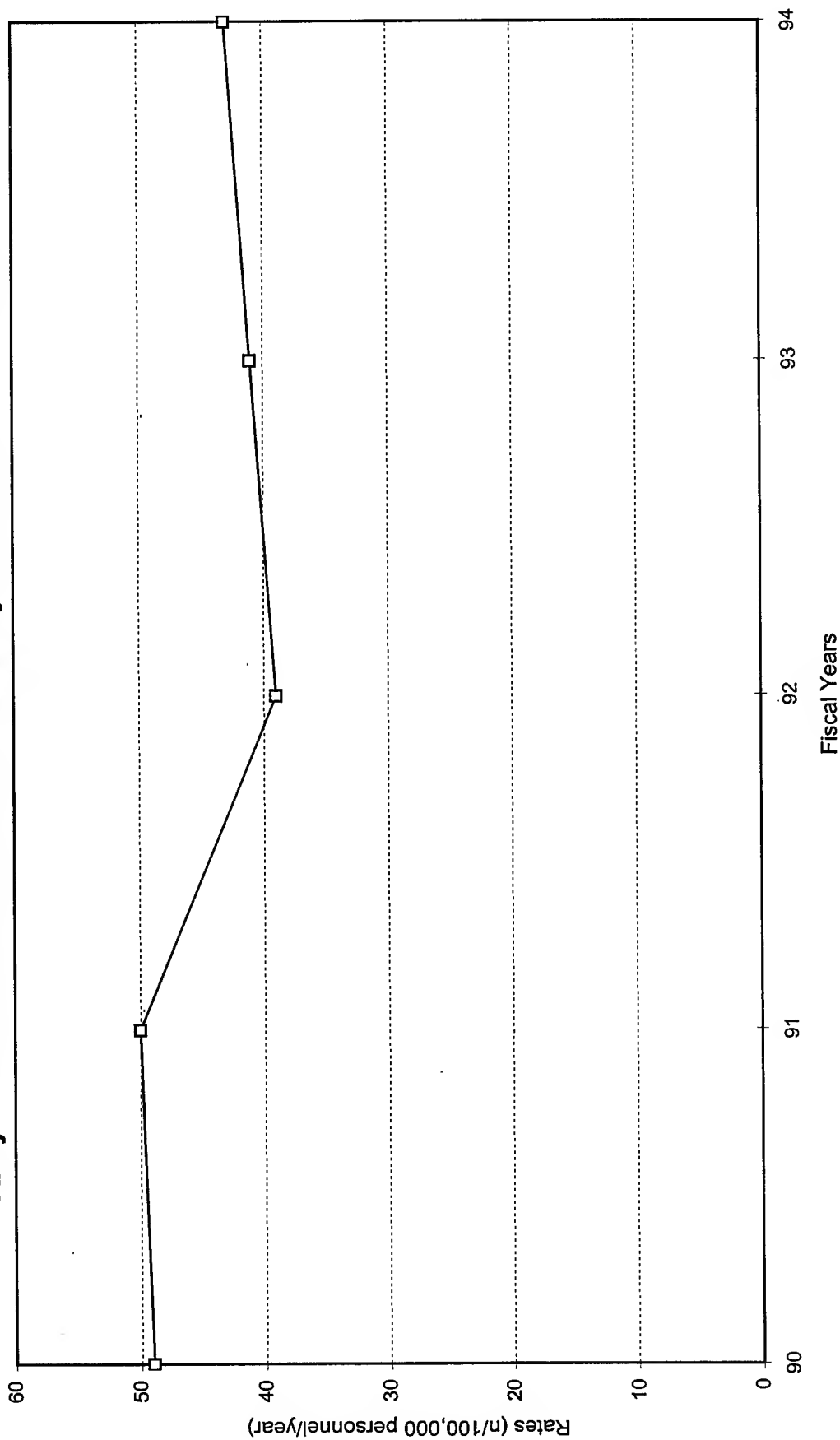
Figure 3-5 illustrates the rates of accidental death for Army military personnel for FY 1990-1994. Rates of accidental death decreased 12% from 49 per 100,000 personnel in FY 1990 to 43 per 100,000 personnel in FY 1994.

Worksheet Data for Figure 3-5

Army - Rates of Accidental Death by Fiscal Year*			
1990	1991	1992	1994
49	50	39	43

* Rates per 100,000 personnel calculated using denominator data in Table 1-7. Accident rates include some Reserve and National Guard cases in the numerator that may not be properly represented in the denominator.

Army - Rates of Accidental Death for Military Personnel,* FY 1990-1994



* Data include active duty, Reserve, and National Guard.

Numerator Source: U.S. Army Safety Center, Washington, DC, 1995.

Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 3-5

Figure 3-6 illustrates the rates of death by type of accident for Army military personnel for FY 1990-1994. Deaths by privately owned vehicles decreased 19% from 26 per 100,000 personnel in FY 1990 to 21 per 100,000 personnel in FY 1994. However, from FY 1993 to FY 1994, privately owned vehicle death rates increased 24%. Upward trends such as this have been seen in the past (see Figure 3-7); in order to determine if this is a true upward trend, more data points need to be examined.

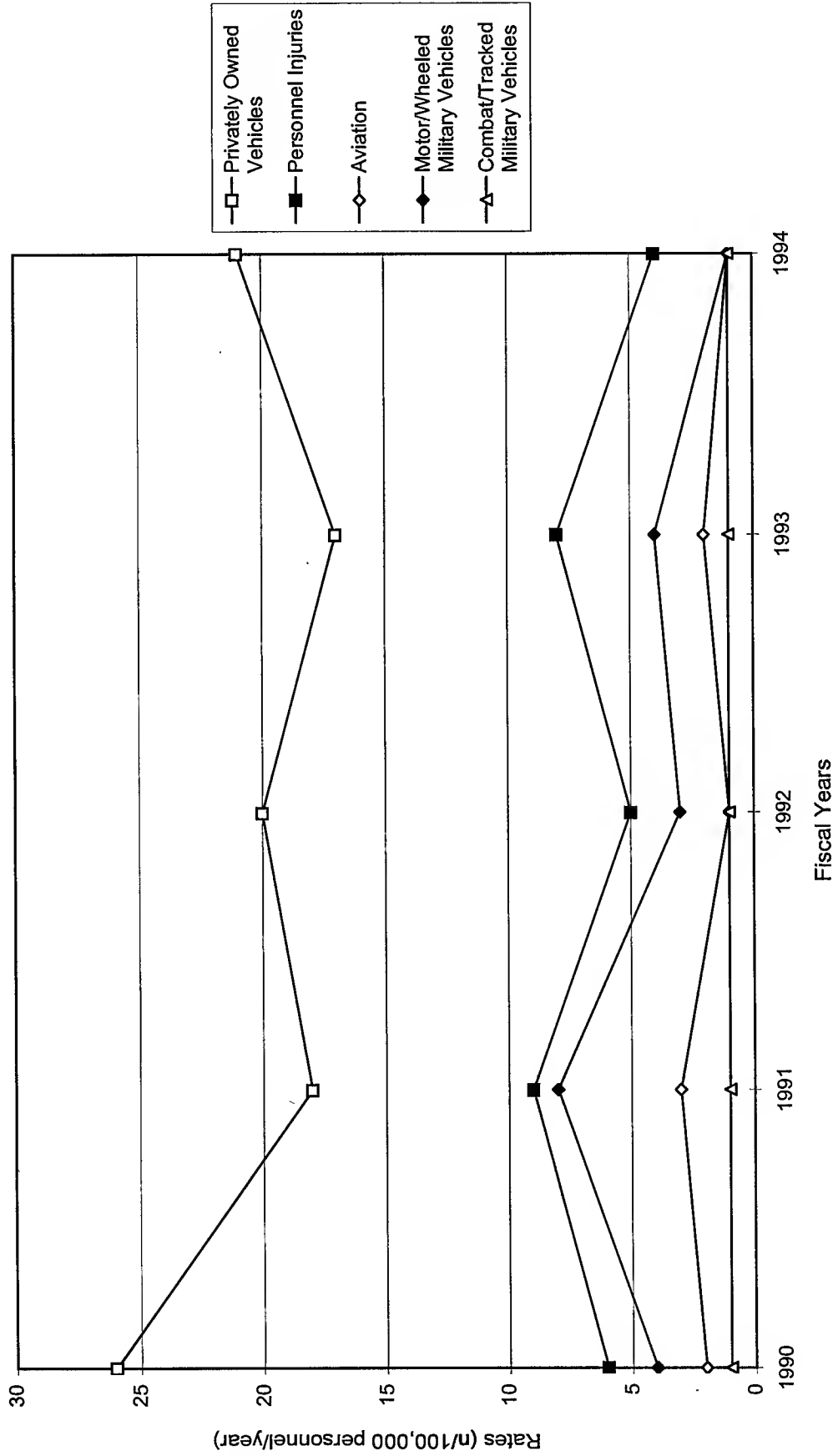
Worksheet Data for Figure 3-6

Types of Accidents (Rank Based on 1994 Data)	Army - Rates of Death by Fiscal Year*				
	1990	1991	1992	1993	1994
Privately Owned Vehicles	26	18	20	17	21
Personnel Injuries	6	9	5	8	4
Aviation	2	3	1	2	1
Motor/Wheeled Military Vehicles	4	8	3	4	1
Combat/Tracked Military Vehicles	1	1	1	1	1

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Accident rates may be overestimated since the numerator contains Reserve and National Guard cases that may not be represented in the denominator.

Army - Rates of Accidental Death by Type for Military Personnel,* FY 1990-1994



* Data include active duty, Reserve, and National Guard.

Numerator Source: U.S. Army Safety Center, Washington, DC, 1995, and personal communication, 1997.

Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 3-6

Figure 3-7 illustrates the rates of death by privately owned and military vehicles for Army military personnel for FY 1980-1994.

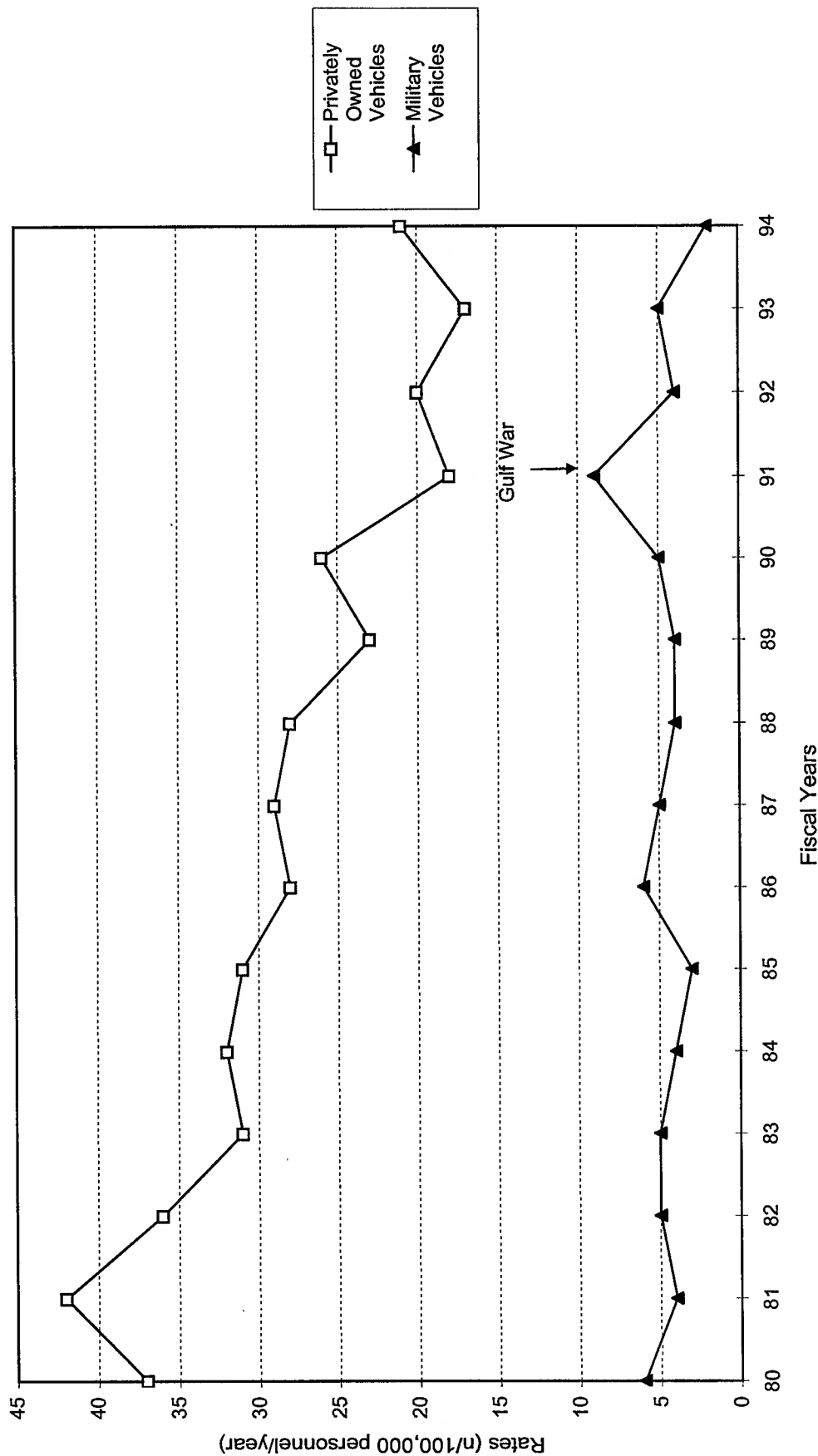
- Deaths caused by privately owned vehicles decreased 43% from 37 per 100,000 personnel in FY 1980 to 21 per 100,000 personnel in FY 1994.
- Deaths caused by military vehicles have remained relatively constant over this 15-year period.

Worksheet Data for Figure 3-7

Types of Accidents	Army - Rates of Death by Fiscal Year*														
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Privately Owned Vehicles	37	42	36	31	32	31	28	29	28	23	26	18	20	17	21
Military Vehicles	6	4	5	5	4	3	6	5	4	4	5	9	4	5	2

* Rates per 100,000 personnel calculated using denominator data in Table 1-7. Accident rates may be overestimated since the numerator contains Reserve and National Guard cases that may not be represented in the denominator.

Army - Rates of Death by Privately Owned and Military Vehicles for Military Personnel,* FY 1980-1994



* Data include active duty, Reserve, and National Guard.

Source: U.S. Army Safety Center, ORSA/Stats Branch, Washington, DC, 1995, and personal communication, 1997.

Figure 3-7

Figure 3-8 illustrates the rates of death by privately owned and military vehicles for Army military men and women for FY 1980-1994.

- There is an overall downward trend for deaths by privately owned vehicles for the entire period among men and women.
- Deaths by privately owned vehicles among men decreased 45% from 38 per 100,000 personnel in FY 1980 to 21 per 100,000 personnel in FY 1994.
- Deaths by privately owned vehicles among women decreased 35% from 26 per 100,000 personnel in FY 1980 to 17 per 100,000 personnel in FY 1994 ; however, the last 3 years show an upward trend reflecting a similar trend in the civilian world.
- Deaths by military vehicles among both men and women remained relatively low for the entire period except for the rise in 1991, which was due to the Gulf War.

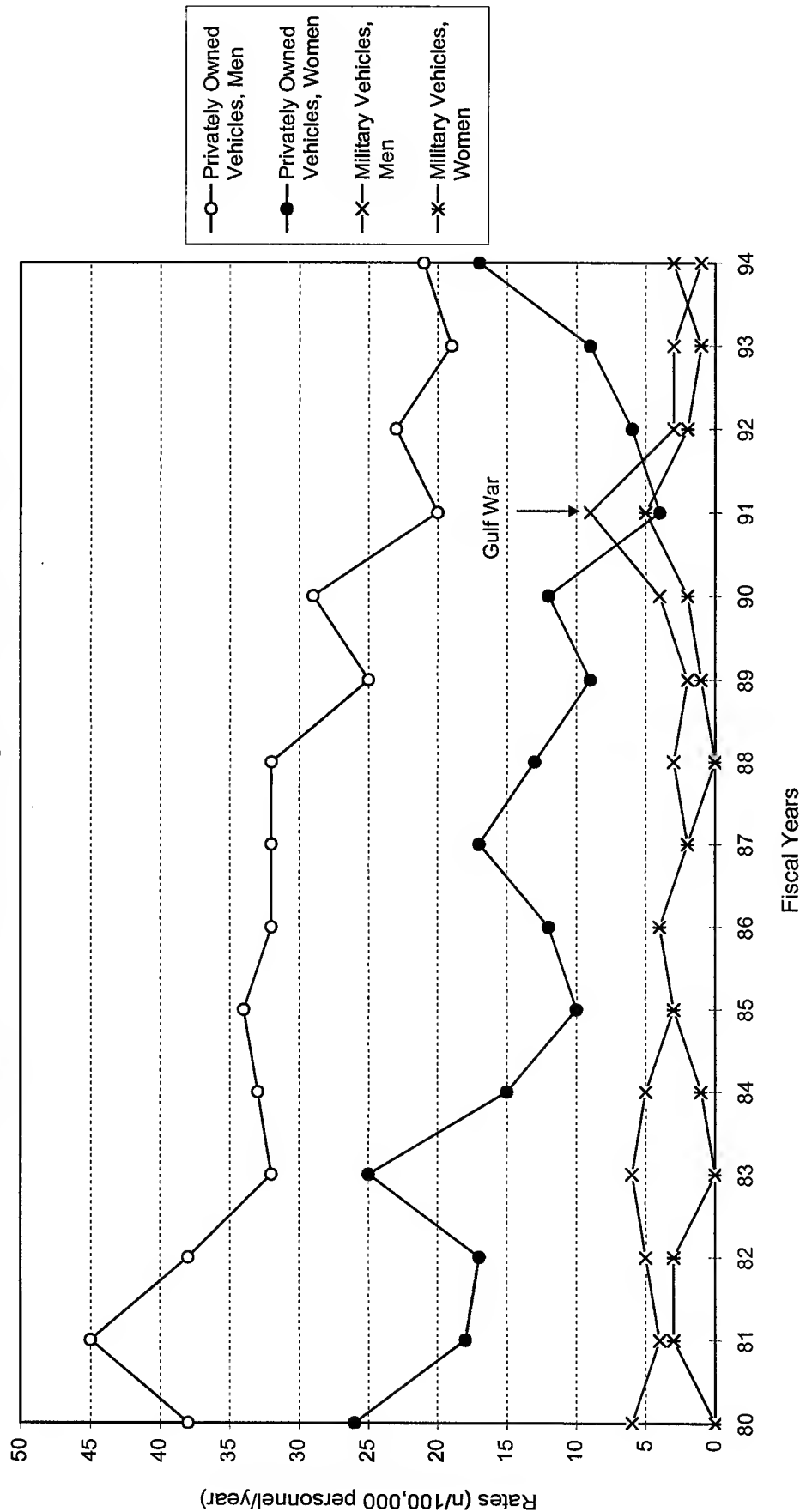
As is true of all motor vehicle accident rates presented in this Atlas, the denominator is total population and may not reflect changes in exposure over time (e.g., vehicle miles traveled).

Worksheet Data for Figure 3-8

Army - Rates of Death by Fiscal Year*															
Types of Accidents	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	38	45	38	32	33	34	32	32	32	25	29	20	23	19	21
Privately Owned Vehicles, Men	26	18	17	25	15	10	12	17	13	9	12	4	6	9	17
Privately Owned Vehicles, Women	6	4	5	6	5	3	4	2	3	2	4	9	3	3	1
Military Vehicles, Men	0	3	3	0	1	3	4	2	0	1	2	5	2	1	3
Military Vehicles, Women															

* Rates per 100,000 personnel calculated using denominator data in Table 1-7. Accident rates may be overestimated since the numerator contains Reserve and National Guard cases that may not be represented in the denominator.

Army - Rates of Death by Privately Owned and Military Vehicles for Male and Female Military Personnel,* FY 1980-1994



* Data include active duty, Reserve, and National Guard.

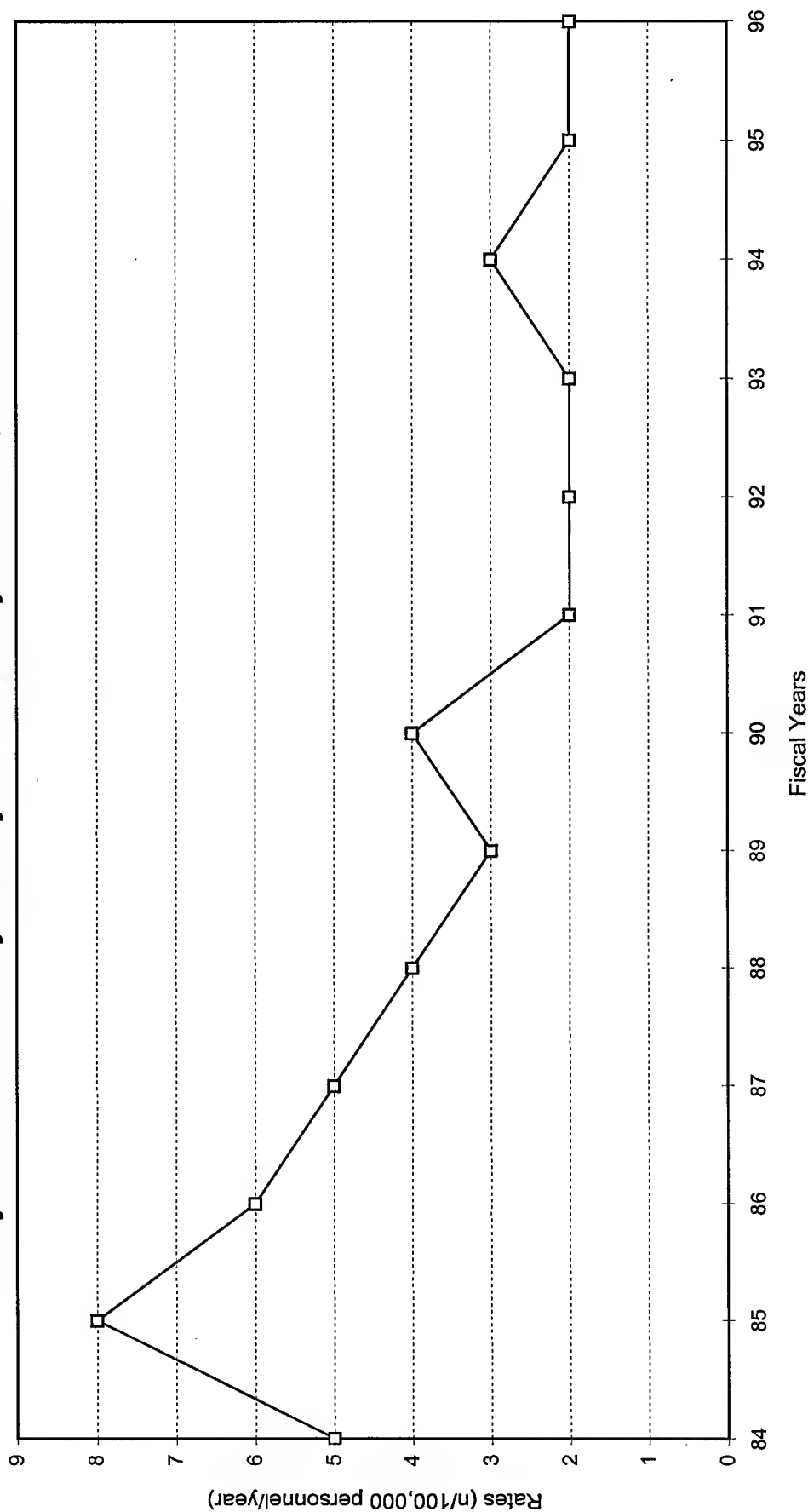
Source: U.S. Army Safety Center, ORSA/Stats Branch, Washington, DC, 1995.

Figure 3-8

Worksheet Data for Figure 3-9

* Rates per 100,000 personnel calculated using denominator data in Table 1-7. Accident rates may be overestimated since the numerator contains Reserve and National Guard cases that may not be represented in the denominator.

Army - Rates of Death by Motorcycles for Military Personnel,* FY 1984-1996



* Data include active duty, Reserve, and National Guard.

Source: U.S. Army Safety Center, Washington, DC, 1997.

Figure 3-9

Figure 3-10 illustrates the rates of Class A flight accidents for Army military personnel for FY 1973-1996. The rates are variable, but there is a downward trend from 4 per 100,000 flight hours in FY 1973 to 0.7 per 100,000 flight hours in FY 1996.

Worksheet Data for Figure 3-10

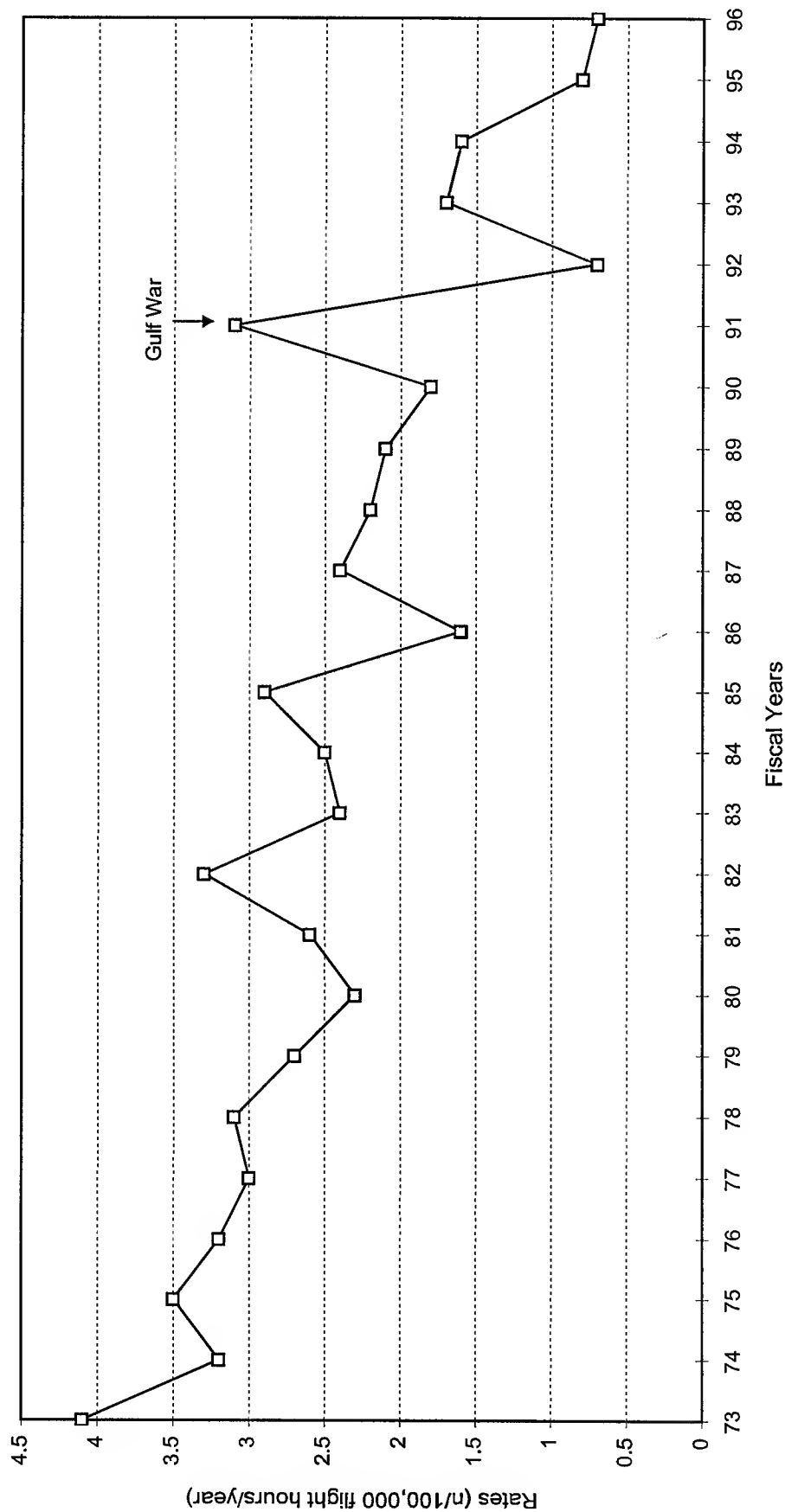
Army - Rates of Class A Flight Accidents by Fiscal Year*												
1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
4.0	3.2	3.5	3.2	3.0	3.1	2.7	2.3	2.6	3.3	2.3	2.5	2.5

Worksheet Data for Figure 3-10—Continued

Army - Rates of Class A Flight Accidents by Fiscal Year*												
1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2.9	1.6	2.4	2.2	2.1	2.1	3.1	0.7	1.7	1.6	0.8	0.7	0.7

* Rates per 100,000 flight hours.

Army - Rates of Class A* Flight Accidents for Military Personnel,† FY 1973-1996



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

† Data include active duty, Reserve, and National Guard.

Source: U.S. Army Safety Center, Washington, DC, 1997.

Figure 3-10

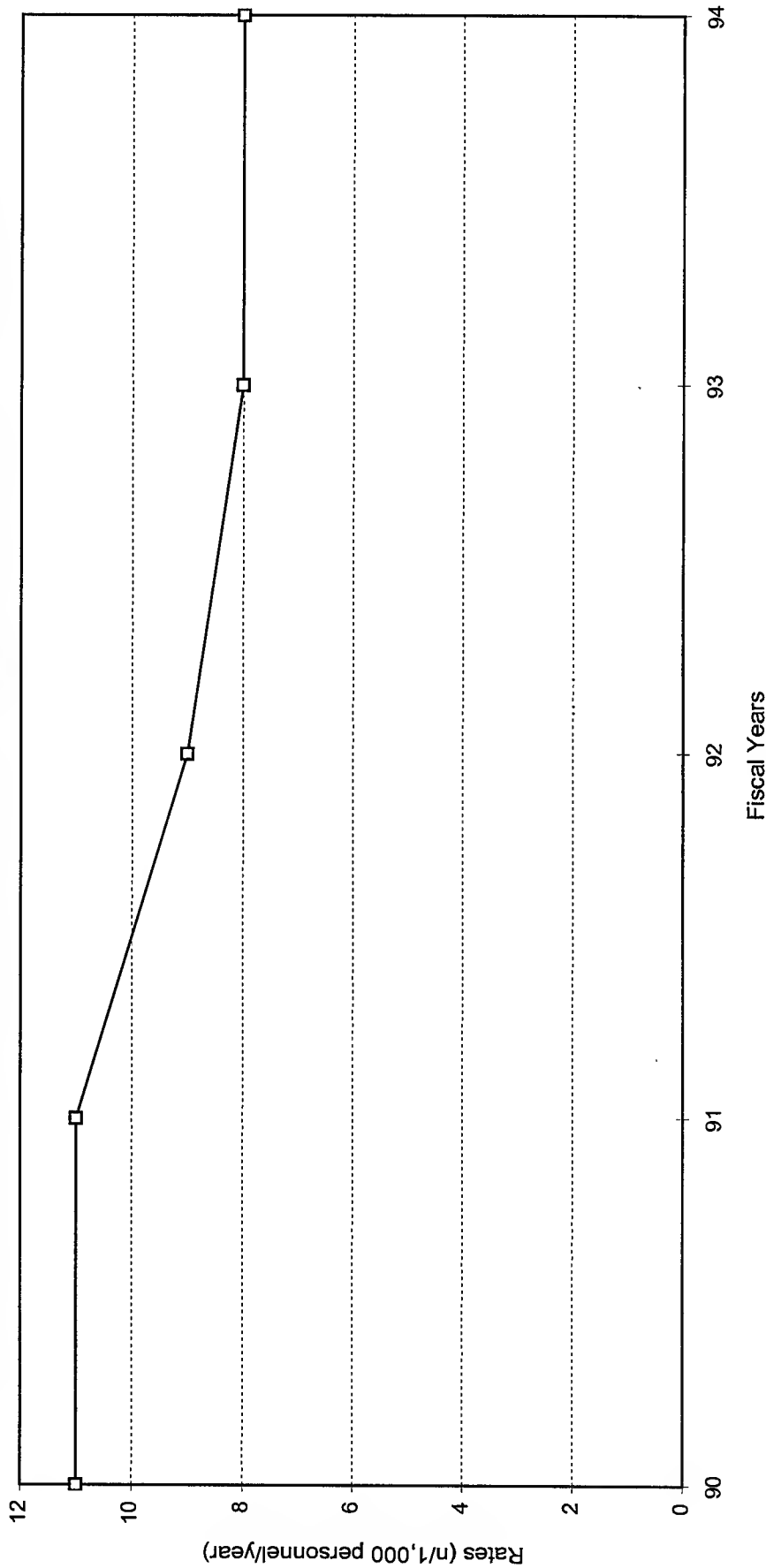
Figure 3-11 illustrates the overall rates of Class A-C accidents for Army military personnel for FY 1990-1994. Overall rates of Class A-C accidents decreased 27% from 11 per 1,000 personnel in FY 1990 to 8 per 1,000 personnel in FY 1994.

Worksheet Data for Figure 3-11

Army - Overall Rates of Class A-C Accidents by Fiscal Year*			
1990	1991	1992	1993
11	11	9	8

* Rates per 1,000 personnel calculated using denominator data in Table 1-7. Accident rates include some Reserve and National Guard cases in the numerator that may not be properly represented in the denominator.

Army - Overall Rates of Class A-C* Accidents for Military Personnel,† FY 1990-1994



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.
 Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.
 Class C = Lost time; \$10K or more, but less than \$200K.
 † Data include active duty, Reserve, and National Guard.

Numerator Source: U.S. Army Safety Center, Washington, DC, 1995.

Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 3-11

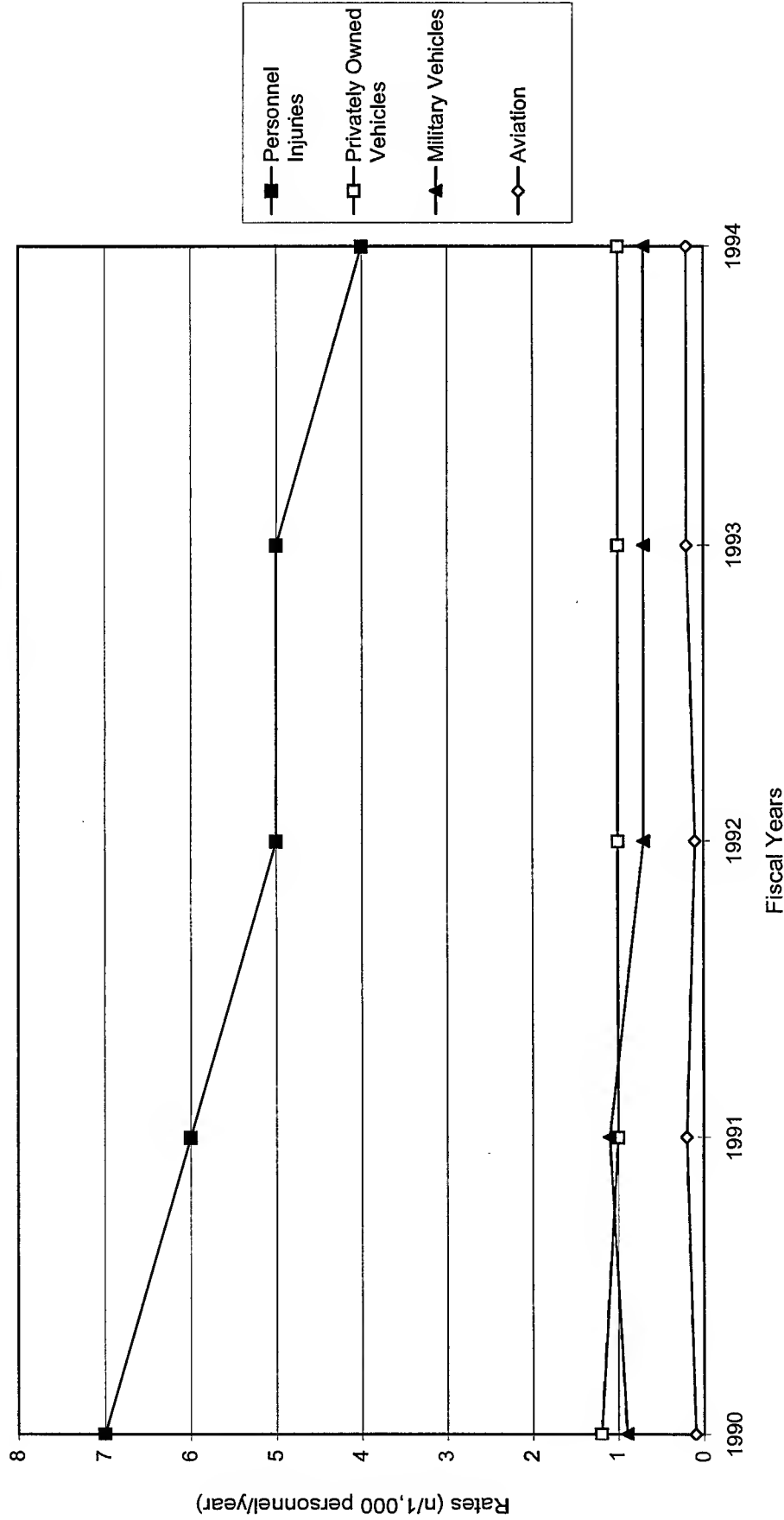
Figure 3-12 illustrates the rates of Class A-C accidents by type for Army military personnel for FY 1990-1994. There was a 43% reduction in the rate of occurrence for personnel injury accidents from 7 per 1,000 persons in FY 1990 to 4 per 1,000 persons in FY 1994. Other Class A-C accident rate categories (privately owned vehicles, military vehicles, and aviation) were relatively constant for the entire 5-year period.

Worksheet Data for Figure 3-12

Types of Accidents (Rank Based on 1994 Data)	Army - Rates of Class A-C Accidents by Fiscal Year*				
	1990	1991	1992	1993	1994
Personnel Injuries	7	6	5	5	4
Privately Owned Vehicles	1.2	1	1	1	1
Military Vehicles	0.9	1.1	0.7	0.7	0.7
Aviation	0.1	0.2	0.1	0.2	0.2

* Rates per 1,000 personnel calculated using denominator data in Table 1-7. Accident rates may be overestimated since the numerator contains Reserve and National Guard cases that may not be represented in the denominator.

Army - Rates of Class A-C* Accidents by Type for Military Personnel,† FY 1990-1994



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.
 Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.
 Class C = Lost time; \$10K or more, but less than \$200K.
 † Data include active duty, Reserve, and National Guard.

Figure 3-12

Numerator Source: U.S. Army Safety Center, Washington, DC, 1995, and personal communication, 1997.
 Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

3-7. Navy and Marine Corps

The Naval Safety Center data for Navy and Marine Corps military personnel are presented in three parts:

- The Navy and Marine Corps Summary. The Navy and Marine Corps safety data presented in this section are summarized in four tables.
 - The overall Navy summary is presented in Table 3-6.
 - The overall Marine Corps summary is presented in Table 3-7.
 - The data in figures 3-13 through 3-16 are summarized in Table 3-8.
 - The data in figures 3-17 through 3-24 are summarized in Table 3-9.
- Magnitude of the Injury Problem Relative to Other Causes of Accidents.
 - The distribution of deaths and costs of mishaps by mishap types for Navy personnel for FY 1994 are displayed in figures 3-13 and 3-14, respectively.
 - The distribution of deaths and costs of mishaps by mishap types for Marine Corps personnel for FY 1994 are displayed in figures 3-15 and 3-16, respectively.
- Trends of Navy and Marine Corps Mishap Deaths and Overall Mishaps Relative to Other Causes Over Time.
 - Rates of death by Class A military (operational*) mishaps, private motor vehicles (nonoperational†), and motorcycles for Navy and Marine Corps personnel are displayed in figures 3-17 through 3-22, respectively.
 - Rates of Class A flight mishaps for Navy and Marine Corps personnel combined are displayed in figures 3-23 and 3-24.

* Navy operations are defined as official, authorized activities conducted or provided by Navy-owned and maintained facilities. Facilities include aircraft, surface ships, submarines, government motor vehicles, and shore establishments including service-related facilities. Navy operational mishaps are defined as those in which DoD or non-DoD property is damaged or any person (military, federal civilian, non-DoD) is injured as a direct result of the execution of specific Navy operations.

† Navy nonoperational mishaps are defined as those which are not Navy operational mishaps. These consist of (1) cases in which Navy military personnel or any military personnel assigned to the Navy are injured while using Navy-owned and maintained service-related facilities, such as pools, athletic fields, retail stores, clubs, child centers, and housing; (2) cases in which any person (military, federal civilian, non-DoD) is injured due to negligence in the maintenance of Navy-owned and maintained service-related facilities; and (3) cases in which off-duty Navy military personnel or military personnel assigned to the Navy are injured in any other capacity not previously mentioned and not considered as operational.

The Navy and Marine Corps Summaries.

Table 3-6. Overall Summary of Navy Fatality and Mishap Data for Military Personnel

Table 3-6. Overall Summary of Navy Fatality and Mishap Data for Military Personnel								
FY	Total Navy Population	Number, Rates, and Trends of Deaths (FY 1990 and 1994)			Number, Rates, and Trends of Class A-C Mishaps* (FY 1990 and 1994)			Conclusions
		Total	n/1,000 Personnel	Trend, % Change (FY 1990-1994)	Total	n/100,000 Personnel	Trend, % Change (FY 1981-1994)	
1990	579,417	255	44.0	Down 35%	6,715	11.6	†	The fatality rate declined from FY 1990 to 1994. The mishap rate also declined, but a change in reporting requirements makes an exact comparison impossible.
1994	468,662	135	28.8		1,872	4.0		

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

† Starting 1 January 1991, the minimum reportable injury for Class C Navy mishaps was raised to 5 lost workdays. Accordingly, no comparison of FY 1990 and FY 1994 data is provided.

Table 3-7. Overall Summary of Marine Corps Fatality and Mishap Data for Military Personnel

Table 3-1. Overall Summary of Marine Corps Fatality and Mishap Data for Primary Component								
FY	Total Marine Corps Population	Number, Rates, and Trends of Deaths (FY 1990 and 1994)			Number, Rates, and Trends of Class A-C Mishaps* (FY 1990 and 1994)			Conclusions
		Total	n/1,000 Personnel	Trend, % Change (FY 1990-1994)	Total	n/100,000 Personnel	Trend, % Change (FY 1990-1994)	
1990	196,652	102	51.9	Down 21%	1,550	7.9	Down 24%	Both the fatality and mishap rates declined from FY 1990 to 1994.
1994	174,158	71	40.8		1,044	6.0		

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

Table 3-8. Summary of Navy and Marine Corps Safety Data by Type of Mishap for Military Personnel, FY 1994—Distribution and Costs

Mishap Type	Mishap Deaths		Mishap Costs			Conclusions
	Distribution (%) and Rank Order		Distribution (%) and Rank Order		Cost* (Millions)	
	%	Rank	%	Rank		
Navy						Motor Vehicles <ul style="list-style-type: none">Nonoperational private motor vehicle crashes account for 61-64% of the deaths due to mishaps in the Navy and Marine Corps, but only 5-8% of costs. Aviation <ul style="list-style-type: none">Aviation accounts for 81-84% of all Navy and Marine Corps mishap costs, but contributes only 3-8% to the incidence of fatalities.For the Navy, the total cost of aviation mishaps is nearly 15 times more expensive than the next most costly category, shore/operational.For the Marine Corps, the total cost of aviation mishaps is 10 times more expensive than the next most costly category, nonoperational private motor vehicles.
Marine Corps						
Nonoperational Private Motor Vehicles		1	8%	2	\$15.91	
Other Nonoperational	61%	2	3%	3	\$6.83	
Training/Operations	25%	3	3%	4	\$6.51	
Aviation	10%	4	84%	1	\$165.32	
Industrial	3%	5	1%	5	\$2.34	
Government Motor Vehicles	1%	—	<1%	6	\$0.40	
	—					

* Navy and Marine Corps injury cost data are calculated differently: in most cases, the Navy does not calculate the cost of any injury involving less than 5 lost workdays, while the Marine Corps computes the cost of all injuries resulting in 1 or more lost workdays.

† Includes occupants in four-wheel vehicles, motorcycle riders, pedestrians, and bicyclists struck by a vehicle.

‡ Shore/Recreational includes all recreational mishaps plus all off-duty shore mishaps that are not motor vehicle accidents.

§ Shore Operational includes operational mishaps that are not aviation, afloat, or government motor vehicle.

Table 3-9. Summary of Navy and Marine Corps Safety Data by Type of Mishaps for Military Personnel—Rates and Trends of Deaths

Type of Mishap	Rates and Trends of Deaths								Conclusions	
	n/100,000 Personnel/Year				n/100,000 Flight Hrs/Year					Trend, % Change
	FY81	FY90	FY94		FY51	FY78	FY94			
Military (Operational) Navy Marine Corps	31 —	14 20	10 11		— —	— —	— —	Down 68% (FY81-94) Down 45% (FY90-94)	Rates • Overall rates of Navy and Marine Corps mishap fatalities have been decreasing since FY 1981 and 1990, respectively. Motor Vehicles and Motorcycles • Over a 14-year period, both Navy motor vehicle and motorcycle-related fatality rates have decreased by at least half. Flight • Flight mishap deaths have decreased continuously since the 1950's.	
Private Motor Vehicles* (Nonoperational) Navy Marine Corps	48 —	29 32	18 26		— —	— —	— —	Down 63% (FY81-94) Down 19% (FY90-94)		
Motorcycle-Related Navy Marine Corps	12 —	8 6	4 5		— —	— —	— —	Down 50% (FY81-94) Down 17% (FY90-94)		
Class A † Flight Mishaps Navy/Marine Corps	—	—	—		53.6	—	1.8	Down 97% (FY51-94)		
	—	—	—		—	5.6	1.8	Down 68% (FY78-94)		

* Includes occupants in four-wheel vehicles, motorcycle riders, pedestrians, and bicyclists struck by a vehicle.

† Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

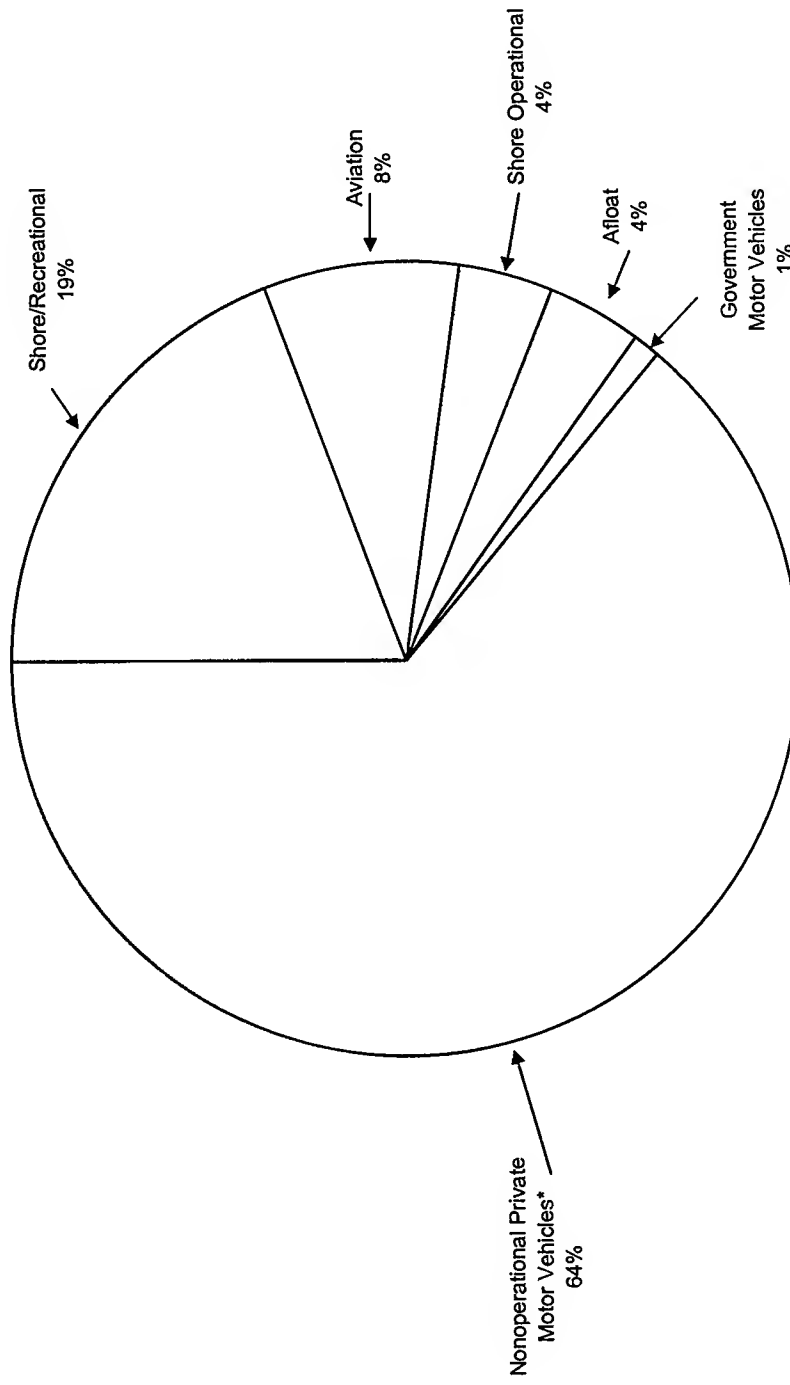
Distribution of Mishaps by Type.

Figure 3-13 illustrates the distribution of deaths by mishap type for Navy military personnel for FY 1994:

- Nonoperational private motor vehicles—64%.
- Shore/recreational—19%.
- Aviation—8%.
- Shore operational—4%.
- Afloat—4%.
- Government motor vehicles—1%.

There were a total of 135 deaths out of a population of 468,662, including the number of Navy personnel killed in Navy mishaps plus the number of Navy personnel killed in Marine Corps aviation mishaps.

Navy - Distribution (%) of Deaths by Mishap Type for Military Personnel, FY 1994



n (deaths) = 135.

population = 468,662.

* Includes occupants in four-wheel vehicles, motorcycle riders, pedestrians, and bicyclists struck by a vehicle.

Source: Naval Safety Center, 1998.

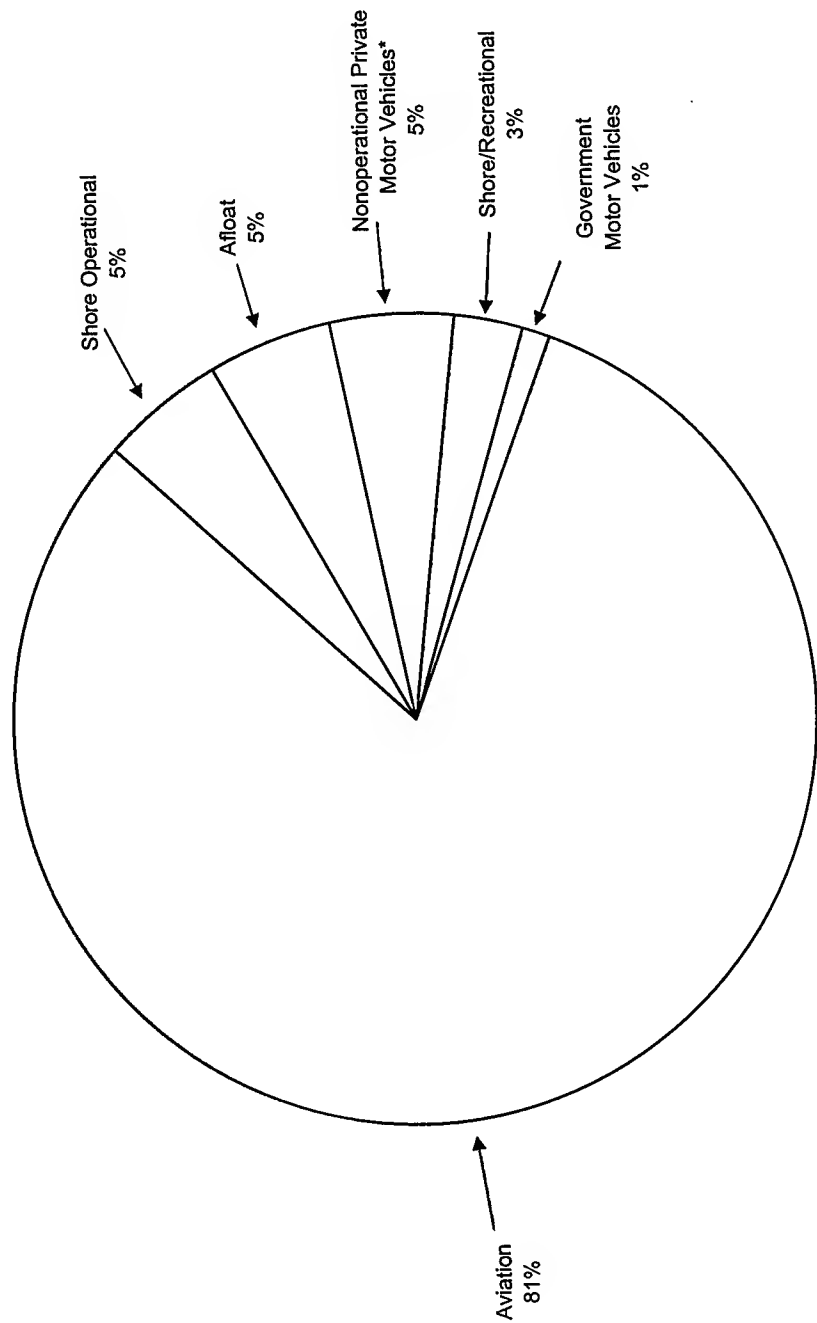
Figure 3-13

Figure 3-14 illustrates the distribution of the costs by mishap type for Navy military personnel for FY 1994. The total cost of \$471,798,968 is distributed as follows:

- Aviation—81% (\$380,704,000).
- Shore operational—5% (\$25,439,390).
- Afloat—5% (\$24,575,051).
- Nonoperational private motor vehicles—5% (\$21,866,966).
- Shore/recreational—3% (\$14,091,124).
- Government motor vehicles—1% (\$4,122,437).

The total cost of aviation mishaps is nearly 15 times as expensive as the next most costly category, shore operational. Aviation accounts for 81% of all mishap costs, but contributes only 8% to the incidence of fatalities (as seen in Figure 3-13).

Navy - Distribution (%) of Costs by Mishap Type for Military Personnel, FY 1994



Total costs = \$471,798,968.

* Includes occupants in four-wheel vehicles, motorcycle riders, pedestrians, and bicyclists struck by a vehicle.

Source: Naval Safety Center, 1998.

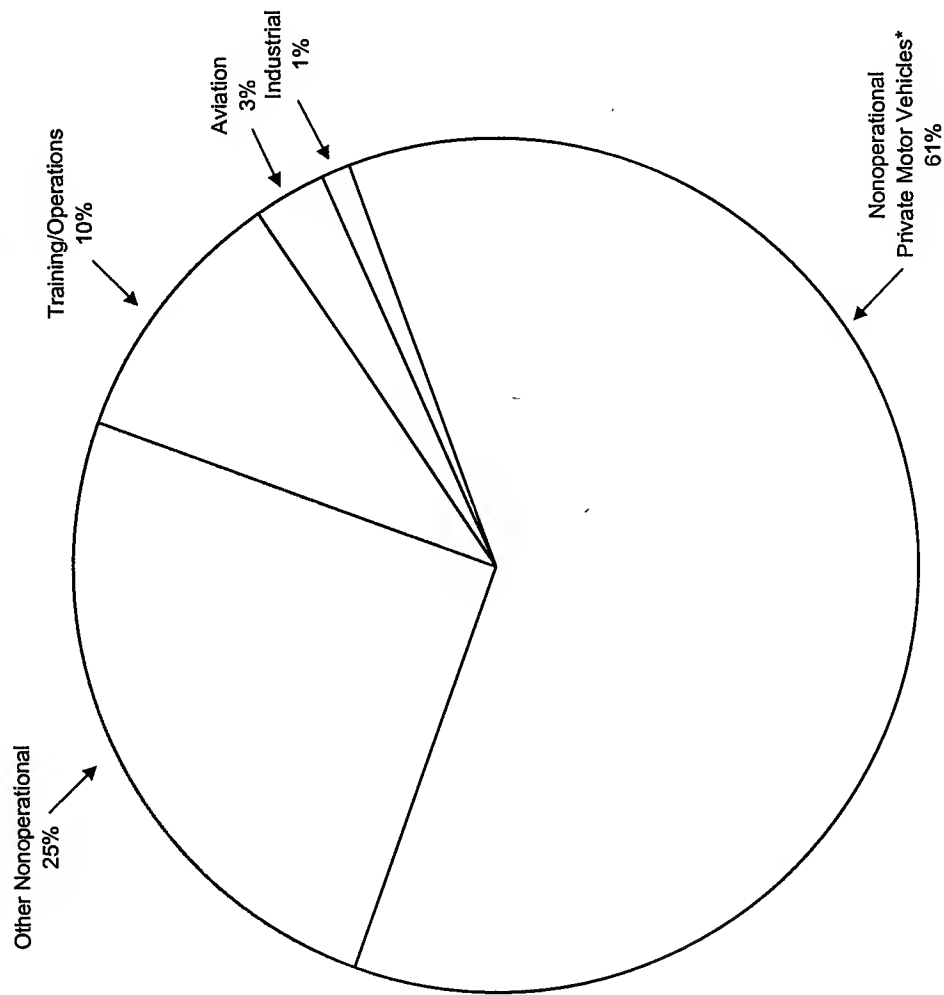
Figure 3-14

Figure 3-15 illustrates the distribution of deaths by mishap type for Marines Corps military personnel for FY 1994:

- Nonoperational private motor vehicles—61%.
- Training/operations—10%.
- Aviation—3%.
- Industrial—1%.
- Other nonoperational—25%.

There were a total of 71 deaths out of a population of 174,158, including the number of Marine Corps personnel killed in Marine Corps mishaps plus the number of Marine Corps personnel killed in Navy aviation mishaps.

Marine Corps - Distribution (%) of Deaths by Mishap Type for Military Personnel, FY 1994



n (deaths) = 71.
population = 174,158.

* Includes occupants in four-wheel vehicles, motorcycle riders, pedestrians, and bicyclists struck by a vehicle.

Source: Naval Safety Center, 1998.

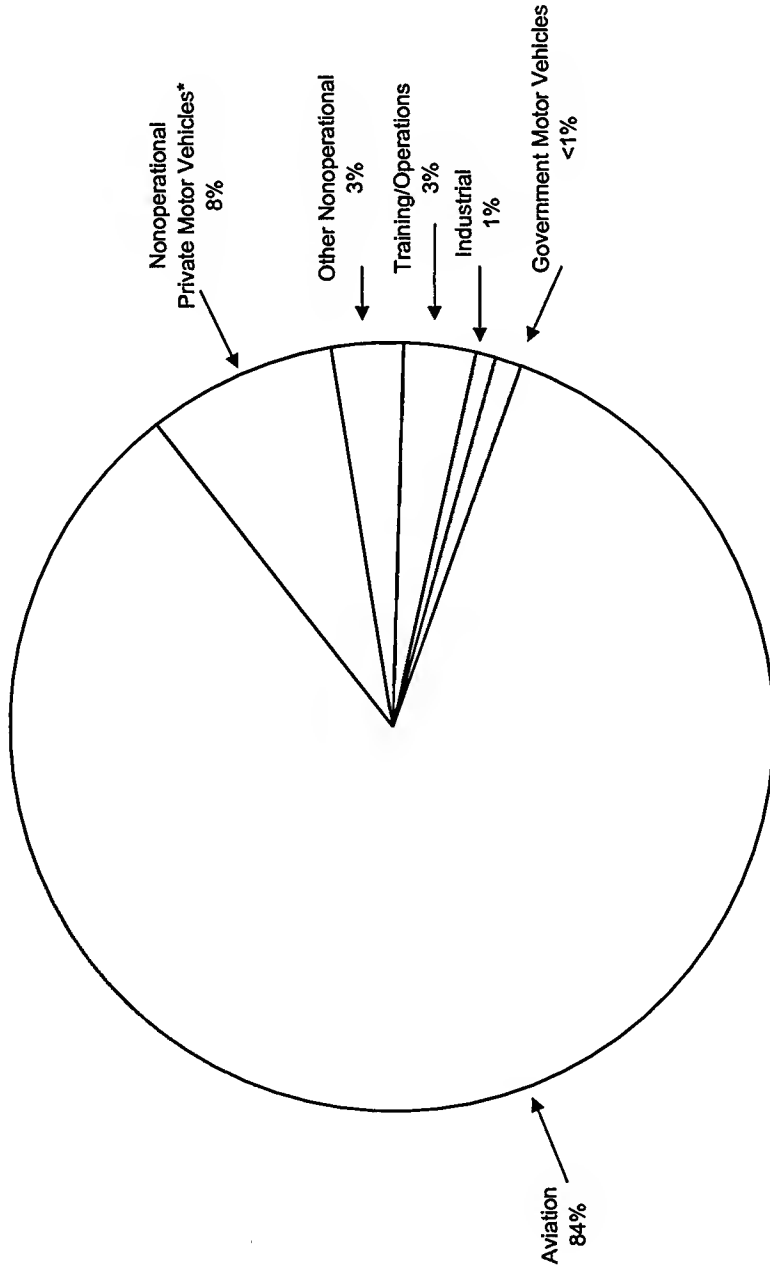
Figure 3-15

Figure 3-16 illustrates the distribution of the costs by mishap type for Marines Corps military personnel for FY 1994. The total cost of \$197,312,403 is distributed as follows:

- Aviation—84% (\$165,320,000).
- Nonoperational private motor vehicles—8% (\$15,906,797).
- Training/operations—3% (\$6,514,795).
- Industrial—1% (\$2,336,985).
- Government motor vehicles—<1% (\$402,237).
- Other nonoperational—3% (\$6,831,589).

Aviation accounts for 84% of all mishap costs, but contributes only 3% to the incidence of fatalities (as seen in Figure 3-15).

Marine Corps - Distribution (%) of Costs by Mishap Type for Military Personnel, FY 1994



Total cost = \$197,312,403.

* Includes occupants in four-wheel vehicles, motorcycle riders, pedestrians, and bicyclists struck by a vehicle.

Source: Naval Safety Center, 1998.

Figure 3-16

Trends of Navy and Marine Corps Deaths and Overall Mishaps Relative to Other Causes Over Time.

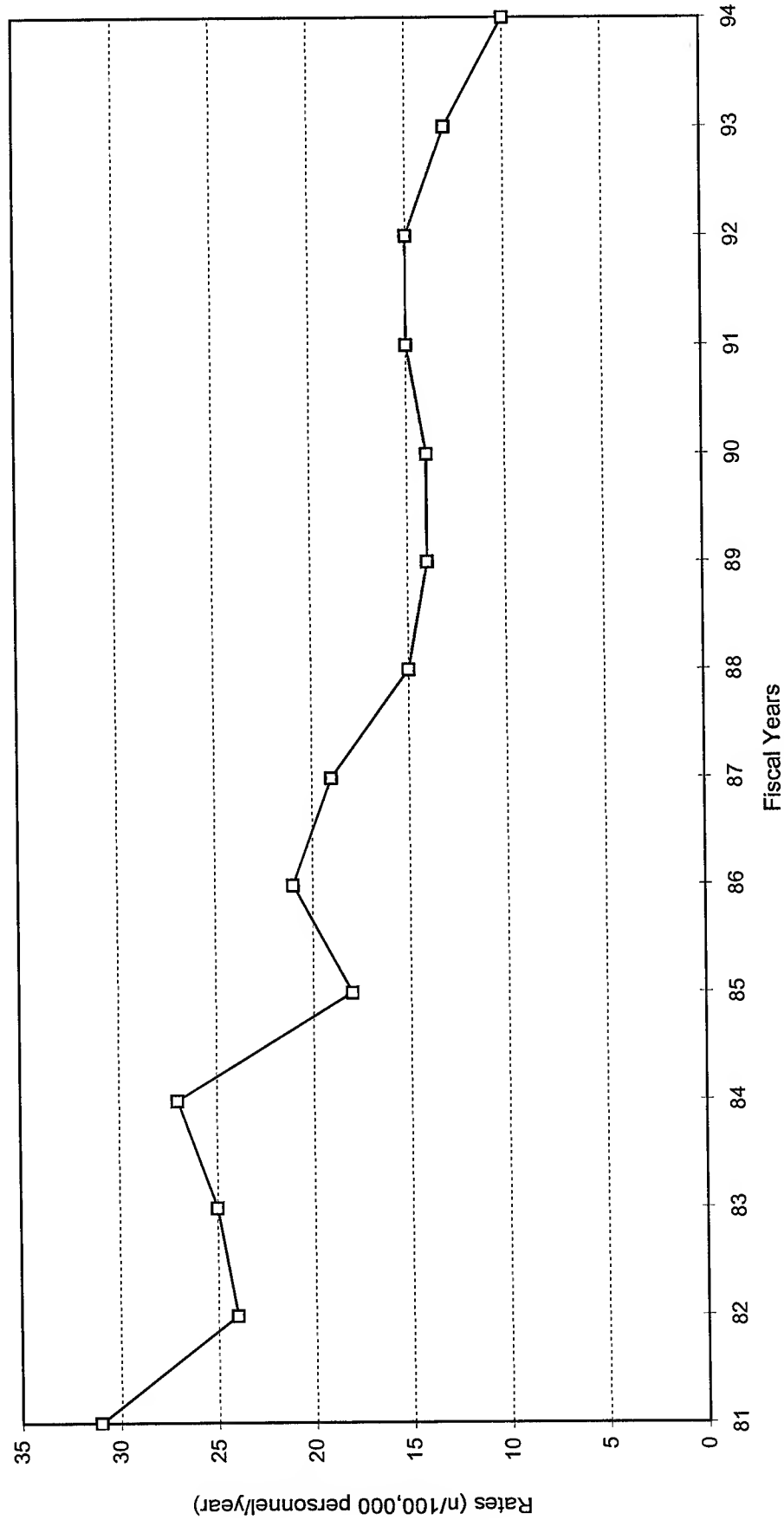
Figure 3-17 illustrates the rates of Class A military (operational) mishaps for Navy military personnel for FY 1981-1994. A decline of 68% for the 14-year period is shown—from 31 per 100,000 personnel for FY 1981 to 10 per 100,000 personnel for FY 1994.

Worksheet Data for Figure 3-17

Navy - Rates of Class A Military (Operational) Mishaps by Fiscal Year*													
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
31	24	25	27	18	21	19	15	14	14	15	15	13	10

* Rates per 100,000 personnel.

Navy - Rates of Class A* Military (Operational) Mishaps for Military Personnel, FY 1981-1994



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Source: Naval Safety Center, 1998.

Figure 3-17

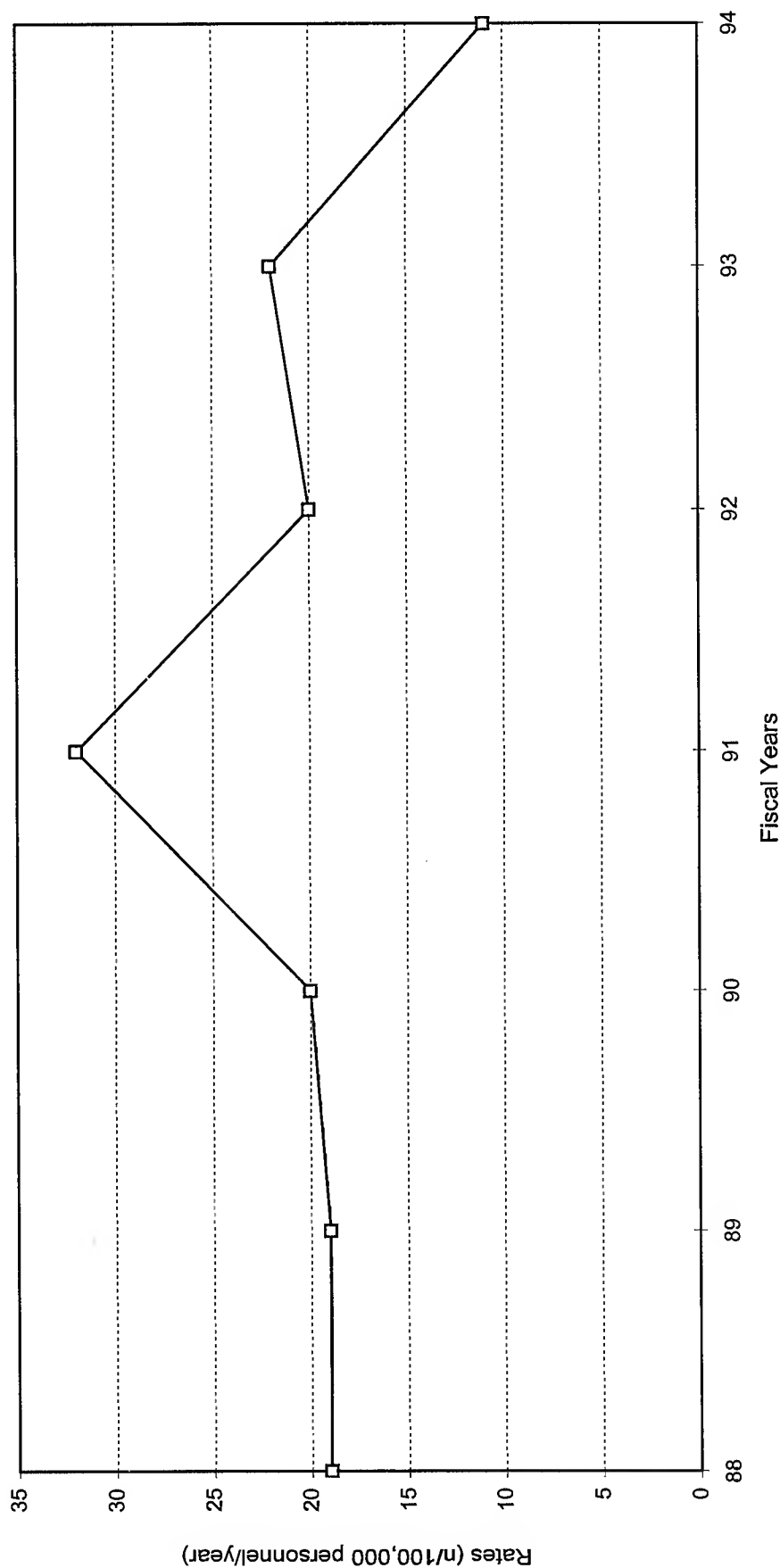
Figure 3-18 illustrates the rates of Class A military (operational) mishaps for Marine Corps military personnel for FY 1988-1994. A decline of 42% for the 7-year period is shown—from 19 per 100,000 personnel for FY 1988 to 11 per 100,000 personnel for FY 1994.

Worksheet Data for Figure 3-18

Marine Corps - Rates of Class A Military (Operational) Mishaps by Fiscal Year*						
1988	1989	1990	1991	1992	1993	1994
19	19	20	32	20	22	11

* Rates per 100,000 personnel.

Marine Corps - Rates of Class A* Military (Operational) Mishaps for Military Personnel, FY 1988-1994†



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

† Marine Corps data are only available for 1988 and beyond.

Source: Naval Safety Center, 1998.

Figure 3-18

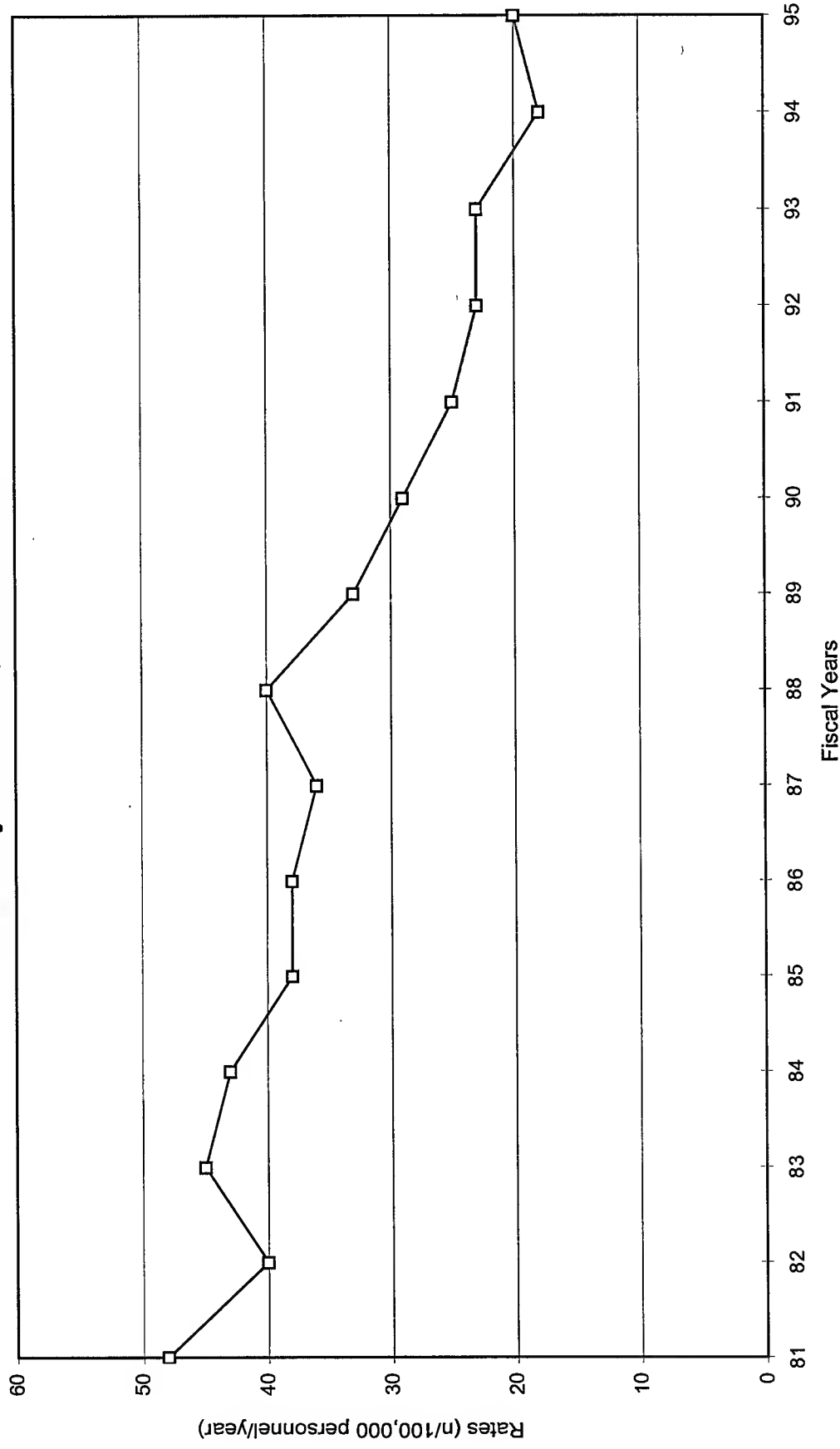
Figure 3-19 illustrates the rates of death by private motor vehicles (nonoperational) for Navy military personnel for FY 1981-1995. Fatality rates declined 58% from 48 per 100,000 personnel in FY 1981 to 20 per 100,000 personnel in FY 1995.

Worksheet Data for Figure 3-19

Navy - Rates of Death by Private Motor Vehicles (Nonoperational) by Fiscal Year*														
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
48	40	45	43	38	38	36	40	33	29	25	23	23	18	20

* Rates per 100,000 personnel.

Navy - Rates of Death by Private Motor Vehicles (Nonoperational)* for Military Personnel, FY 1981-1995



* Includes four-wheel vehicle occupants, motorcycle riders, pedestrians, and bicyclists (struck by a vehicle).

Source: Naval Safety Center, 1998.

Figure 3-19

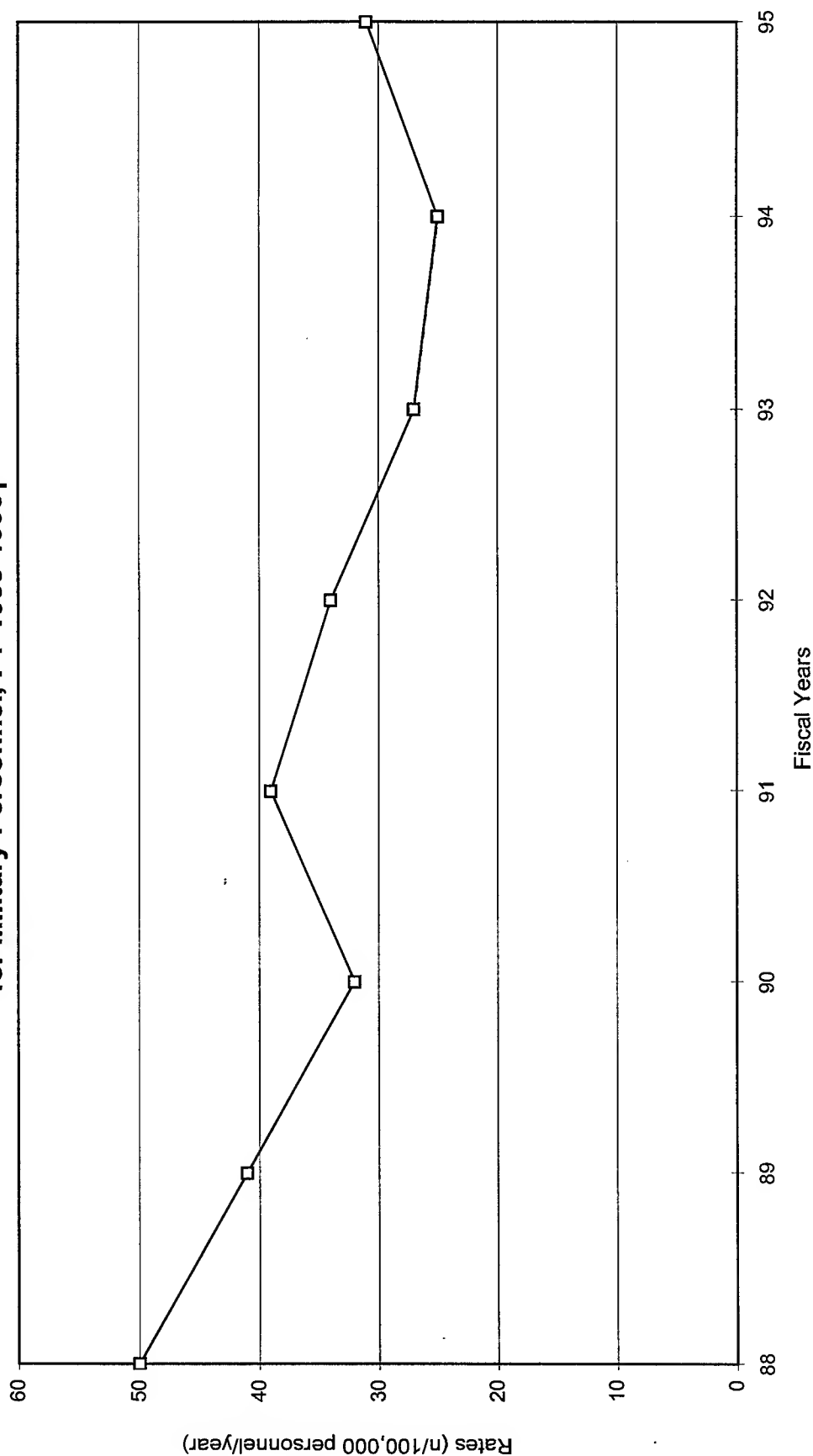
Figure 3-20 illustrates the rates of death by private motor vehicles (nonoperational) for Marine Corps military personnel for FY 1988-1995. Fatality rates declined 38% from 50 per 100,000 personnel in FY 1988 to 31 per 100,000 personnel in FY 1995.

Worksheet Data for Figure 3-20

Marine Corps - Rates of Death by Private Motor Vehicles (Nonoperational) by Fiscal Year*							
1988	1989	1990	1991	1992	1993	1994	1995
50	41	32	39	34	27	26	31

* Rates per 100,000 personnel.

Marine Corps - Rates of Death by Private Motor Vehicles (Nonoperational)* for Military Personnel, FY 1988-1995†



* Includes four-wheel vehicle occupants, motorcycle riders, pedestrians, and bicyclists (struck by a vehicle).

† Marine Corps data are only available for 1988 and beyond.

Source: Naval Safety Center, 1998.

Figure 3-20

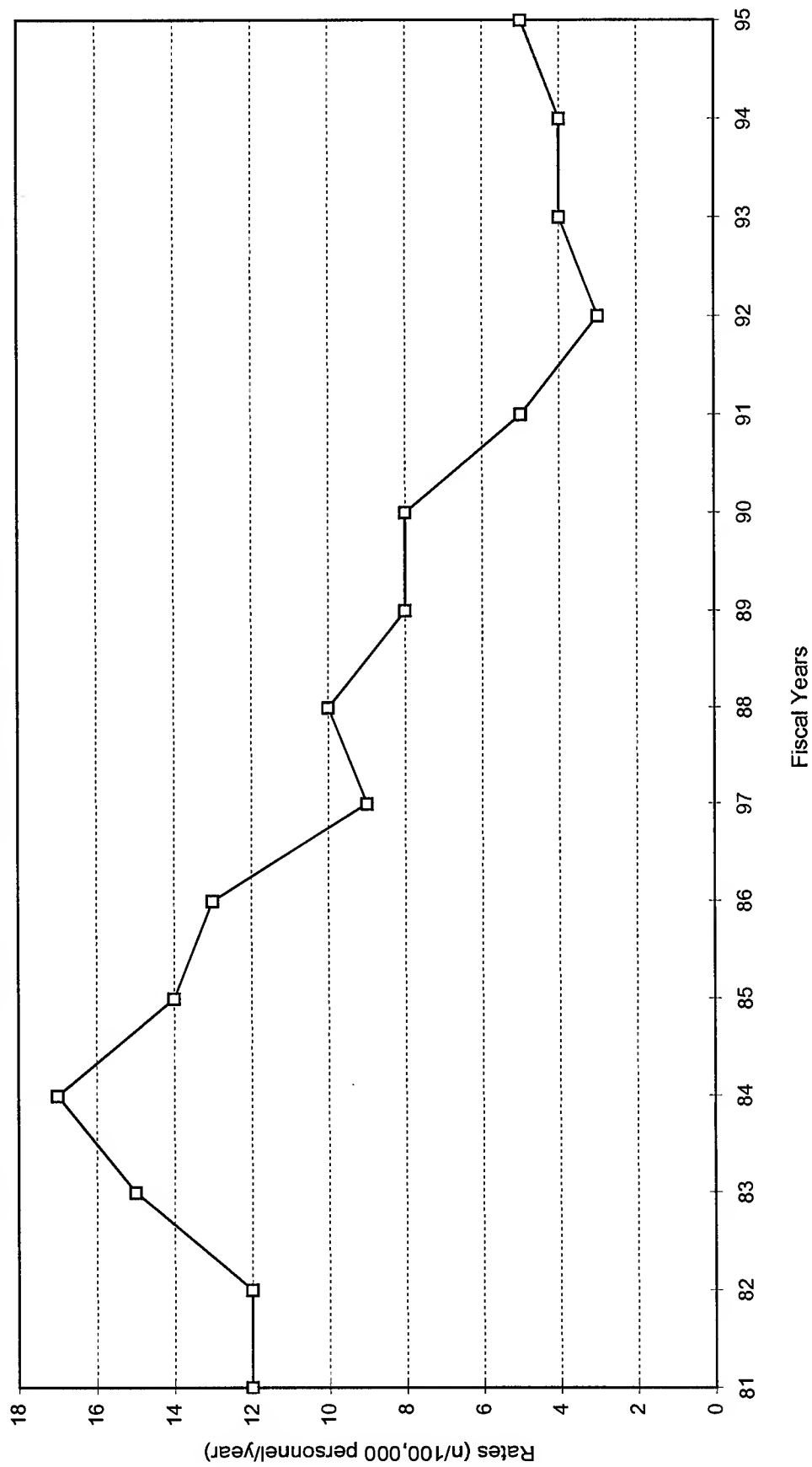
Figure 3-21 illustrates the rates of death by motorcycles for Navy military personnel for FY 1981-1995. Over the 14-year period, fatalities decreased over 76% from a maximum of 17 per 100,000 persons in FY 1984 to an average of 4 per 100,000 persons for the last 4 years of the data set.

Worksheet Data for Figure 3-21

Navy - Rates of Death by Motorcycles by Fiscal Year*														
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
12	12	15	17	14	13	9	10	8	8	5	3	4	4	5

* Rates per 100,000 personnel.

Navy - Rates of Death by Motorcycles for Military Personnel, FY 1981-1995



Source: Naval Safety Center, 1998.

Figure 3-21

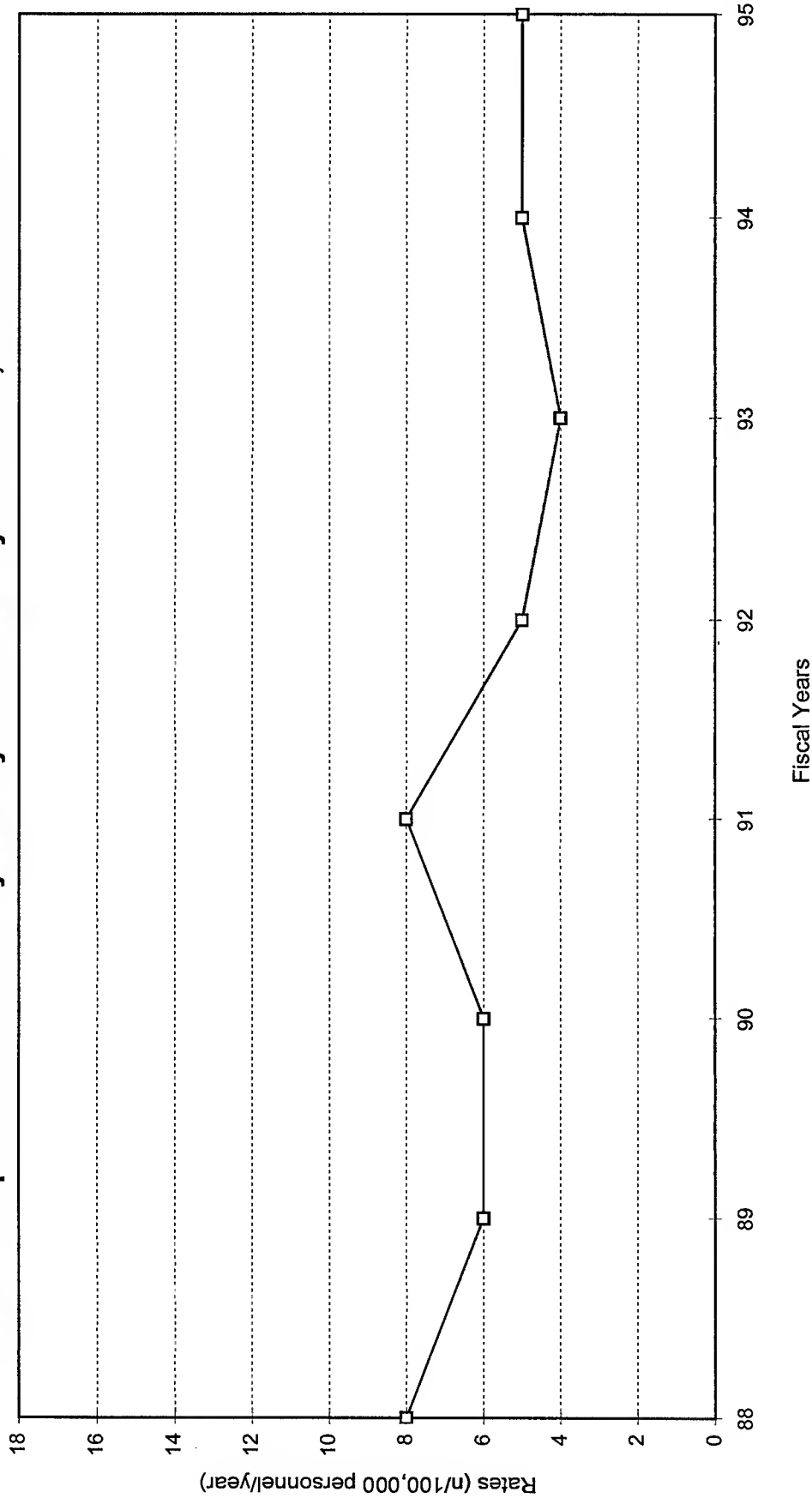
Figure 3-22 illustrates the rates of death by motorcycles for Marine Corps military personnel for FY 1988-1995. Over the 8-year period, fatalities dropped over 37% from 8 per 100,000 persons in FY 1988 to 5 per 100,000 persons in FY 1995.

Worksheet Data for Figure 3-22

Marine Corps - Rates of Death by Motorcycles by Fiscal Year*							
1988	1989	1990	1991	1992	1993	1994	1995
8	6	6	8	5	4	5	5

* Rates per 100,000 personnel.

Marine Corps - Rates of Death by Motorcycles for Military Personnel, FY 1988-1995*



* Marine Corps data are only available for 1988 and beyond.

Source: Naval Safety Center, 1998.

Figure 3-22

Figure 3-23 illustrates the rates of Class A flight mishaps for Navy and Marine Corps military personnel for selected years from 1951-1995. During this period, Navy and Marine Corps aviation fatality rates decreased 96% from 54 per 100,000 flight hours in FY 1951 to 2 per 100,000 flight hours in FY 1995. Some of the specific actions and programs contributing to this decline include:

- Angled carrier decks installed.
- Aviation Safety Center established.
- Naval Aviation Maintenance Program established.
- Replacement Air Group (RAG) concept initiated.
- Naval Air Training and Operating Procedures Standardization (NATOPS) Program established.
- Squadron Safety Program established.
- Safety Instruction Module initiated.

The Navy placed a broad spectrum of programs into effect to achieve the demonstrated improvements, ranging from redesign of carrier decks to intensive training for both ground and flight crews.

Worksheet Data for Figure 3-23

Navy and Marine Corps - Rates of Class A Flight Mishaps by Selected Fiscal/Calendar Years*											
Worksheet Data for Figure 3-26											
FY 1951	FY 1953	FY 1955	FY 1957	FY 1959	FY 1961	FY 1963	FY 1965	FY 1967	FY 1969	CY 1971	CY 1973
54	51	38	31	26	17	15	13	14	14	9	9

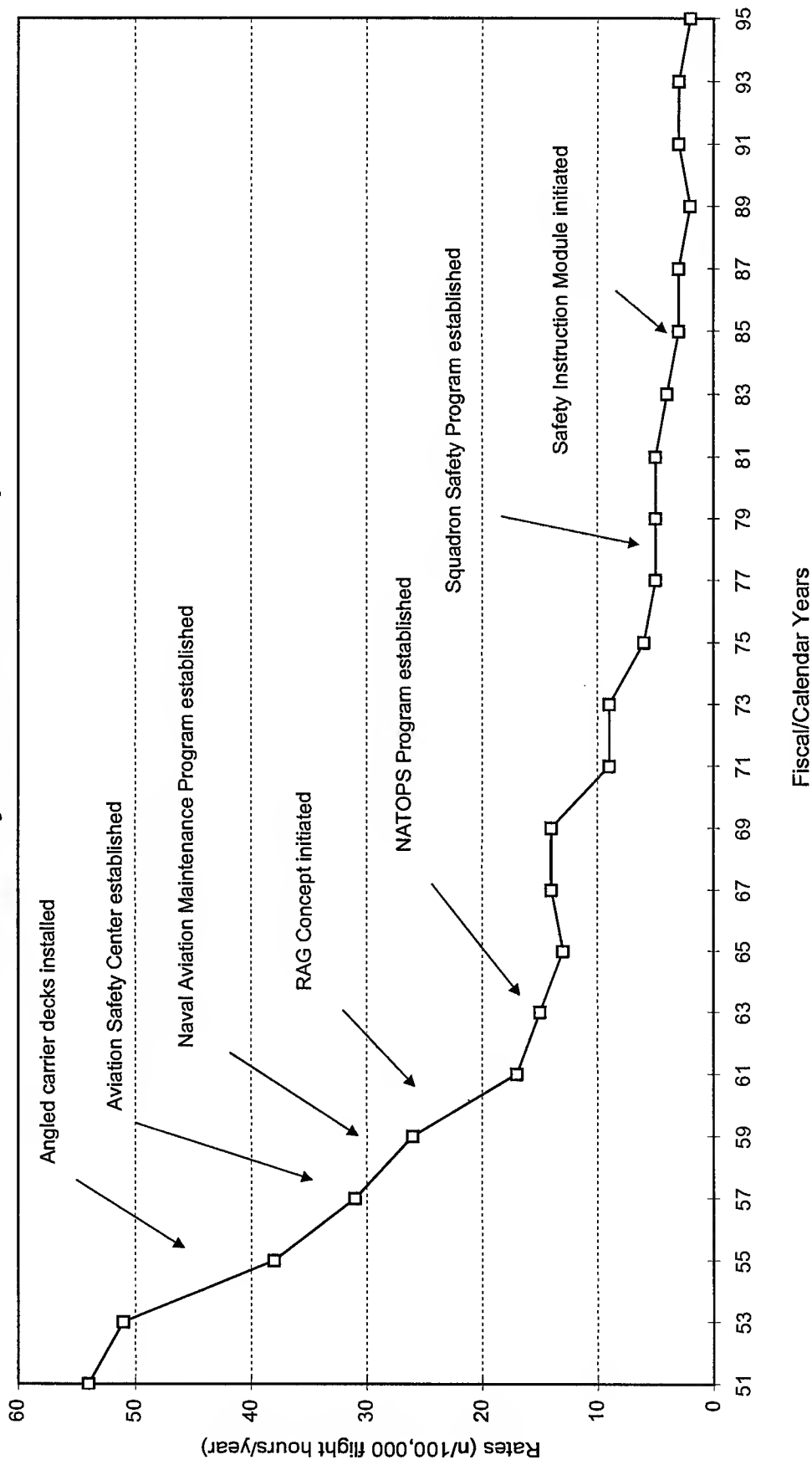
Worksheet Data for Figure 3-23—Continued

Navy and Marine Corps - Rates of Class A Flight Mishaps by Selected Fiscal/Calendar Years*										
CY 1975	1977†	FY 1979	FY 1981	FY 1983	FY 1985	FY 1987	FY 1989	FY 1991	FY 1993	FY 1995
6	5	5	5	4	3	3	2	3	3	2

* Rates per 100,000 flight hours.

† January - September only.

Navy and Marine Corps - Rates of Class A* Flight Mishaps for Military Personnel, 1951-1995†



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.
† All years are fiscal years, except 1971, 1973, and 1975, which are calendar years. 1977 is January - September only.

Source: Naval Safety Center, 1998.

Figure 3-23

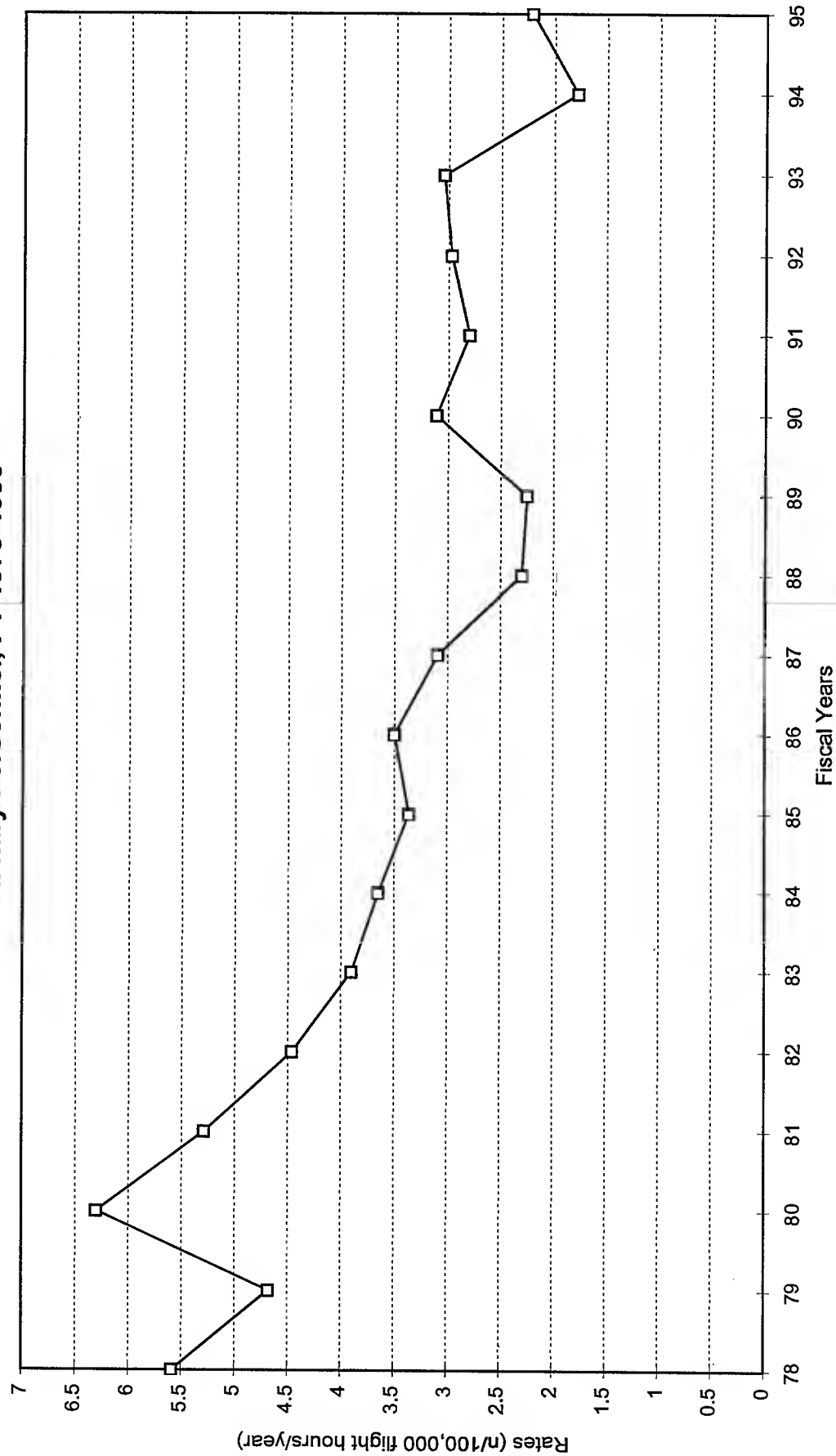
Figure 3-24 illustrates the rates of Class A flight mishaps for Navy and Marine Corps military personnel for FY 1978-1995. During this 18-year period, mishaps decreased by 65% from a high of 6.3 per 100,000 flight hours in FY 1980 to 2.2 per 100,000 flight hours in FY 1995.

Worksheet Data for Figure 3-24

Navy and Marine Corps - Rates of Class A Flight Mishaps by Fiscal Year*																	
1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
5.6	4.7	6.3	5.3	4.5	3.9	3.7	3.4	3.5	3.1	2.3	2.3	3.1	2.8	3.0	3.0	1.8	2.2

* Rates per 100,000 flight hours.

Navy and Marine Corps - Rates of Class A* Flight Mishaps for Military Personnel, FY 1978-1995



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Source: Naval Safety Center, 1998.

Figure 3-24

3-8. Air Force

The Air Force Safety Agency data for active duty personnel are presented in three parts:

- The Air Force Summary. The Air Force safety data presented in this section are summarized in three tables.
 - The overall summary is presented in Table 3-10.
 - The data in figures 3-25 and 3-26 are summarized in Table 3-11.
 - The data in figures 3-27 and 3-29 are summarized in Table 3-12.
- Distribution of Mishaps by Type.
 - The distribution of deaths by mishap type for FY 1994 is displayed in Figure 3-25.
 - The distribution of Class A-C ground mishaps for FY 1994 is displayed in Figure 3-26.
- Trends of Air Force Mishap Deaths and Overall Mishaps Relative to Other Causes Over Time.
 - The rates of death by the top five categories of Class A ground mishaps and for private and government motor vehicles for FY 1980-1994 are displayed in figures 3-27, 3-28, and 3-29.
 - The rates of flight-related injuries and deaths for FY 1990-1994 are displayed in Figure 3-30.

The Air Force Summary.

Table 3-10. Overall Summary of Air Force Fatality and Mishap Data for Active Duty Personnel

FY	Total Air Force Population	Number, Rates, and Trends of Class A Ground Mishaps (FY 1990 and 1994)			Number, Rates, and Trends of Class A-C Ground Mishaps (FY 1990 and 1994)			Conclusions
		Total	n/100,000 Personnel	Trend, % Change (FY 1990-1994)	Total	n/1,000 Personnel	Trend, % Change (FY 1990-1994)	
1990	535,233	139	26	Down 8%	8,176	15	Down 27%	Class A mishap rates and Class A-C ground mishap rates declined from FY 1990 to FY 1994.
1994	426,327	103	24		4,464	11		

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

Table 3-11. Summary of Air Force Safety Data by Type of Class A-C Ground Mishaps for Active Duty Personnel, FY 1994—Distribution and Costs

Mishap Type		Deaths (n = 120)		Class A-C* Ground Mishaps (n = 4,464)				Conclusions
		Distribution (%) and Rank Order		Distribution (%) and Rank Order		Distribution (%) by Estimated Cost		
		%	Rank	%	Rank	%	Cost (Million)	
Private motor vehicles, off duty		55%	1	16%	3	14%	\$18.27	Private Motor Vehicles • The leading cause of death is off duty private motor vehicles followed by flight mishaps. Ground Mishaps • The top five causes account for 97% of all Class A-C ground mishaps. • The leading cause of Class A-C ground mishaps is on duty industry followed by off duty sports and then off duty private motor vehicles. Costs • Flight mishaps account for 58% of all Air Force mishap costs, but contributes only 18% to the incidence of fatalities. • The total cost of flight mishaps is over four times more expensive than the next most costly category, private motor vehicles, off duty.
Flight		18%	2	—	—	58%	\$74.68	
Industry, on duty		8%	3	39%	1	9%	\$11.31	
Sports/recreation, off duty		5%	4	26%	2	4%	\$4.73	
Government motor vehicles		5%	5	1%	—	1%	\$1.35	
Private motor vehicles, on duty		3%	—	—	—	—	\$0.41	
Contractor		1%	—	—	—	3%	\$3.61	
Special purpose vehicles		1%	—	—	—	1%	\$1.04	
Miscellaneous/other, off duty		4%	—	14%	4	3%	\$3.26	
Miscellaneous, on duty		—	—	2%	5	7%	\$8.89	
Sports, on duty		—	—	1%	—	—	\$0.02	
Combat Training		—	—	1%	—	—	\$0.22	

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

Table 3-12. Summary of Air Force Safety Data by Type of Class A Mishaps and Deaths for Active Duty Personnel—Rates and Trends

Mishap Type	Rates and Trends of Deaths				Conclusion
	n/100,000 Personnel/Year			Trend, % Change	
	FY80	FY90	FY94		
Private motor vehicle, off duty	30	17	16	Down 47% (FY 1980-1994)	Private motor vehicle fatality rates decreased 47% from FY 1980 to FY 1994.
Government motor vehicle, on duty	1	1	2	—	
Flight-related	—	8	5	Down 38% (FY 1990-1994)	

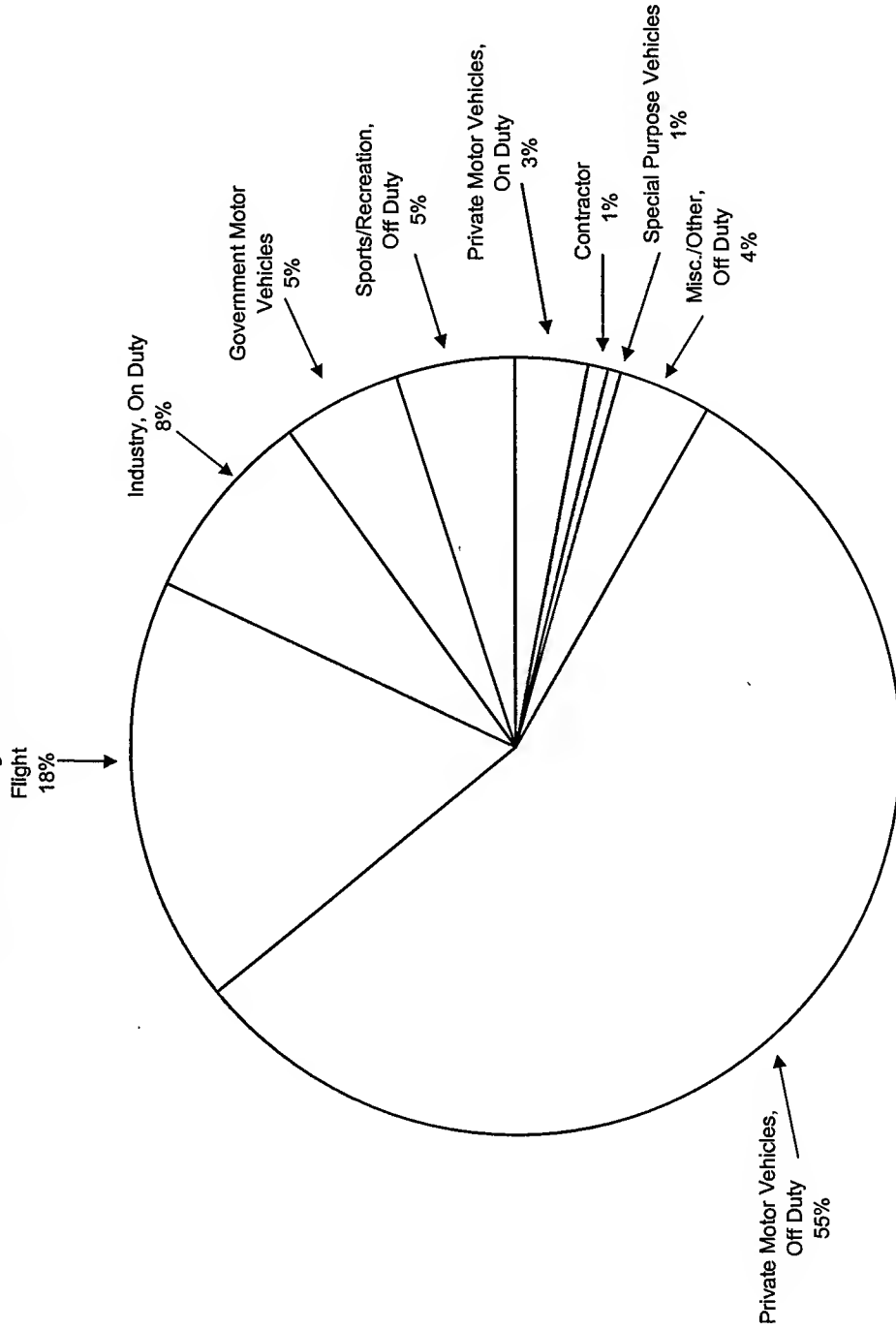
Distribution of Mishaps by Type.

Figure 3-25 illustrates the distribution of deaths by mishap type for active duty Air Force personnel for FY 1994. The top five causes of death were:

- Private motor vehicles, off duty—55%.
- Flight—18%.
- Industry, on duty—8%.
- Government motor vehicles—5%.
- Sports/recreation, off duty—5%.

These top five causes account for 91% of all mishap fatalities. There were a total of 120 deaths out of a population of 426,327.

Air Force - Distribution (%) of Deaths by Mishap Type for Active Duty Personnel, FY 1994



n (deaths) = 120.
population = 426,327.

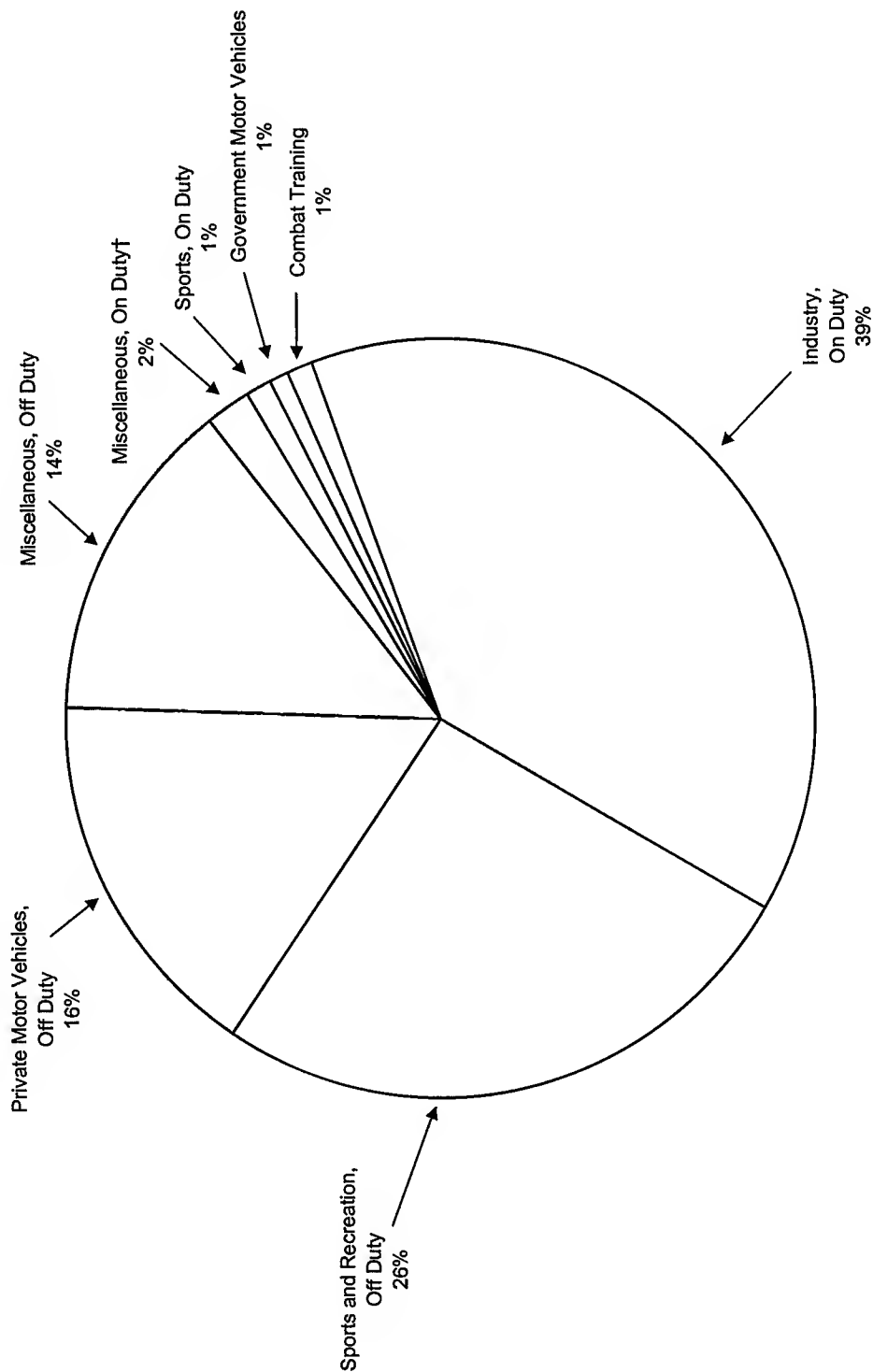
Source: Headquarters, Air Force Safety Agency (HQ AFSA/SEG), 1995.

Figure 3-25

Figure 3-26 illustrates the distribution of Class A-C ground mishaps for active duty Air Force personnel for FY 1994. The top three causes account for 81% of all Class A-C ground mishaps:

- Industry, on duty—39%.
- Sports and recreation, off duty—26%.
- Private motor vehicles, off duty—16%.

Air Force - Distribution (%) of Class A-C* Ground Mishaps for Active Duty Personnel, FY 1994



n = 4,464.

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

† Miscellaneous on-duty includes all mishaps coded as well as those on-duty mishap categories.

Source: Headquarters, Air Force Safety Agency (HQ AFSA/SEG), 1995.

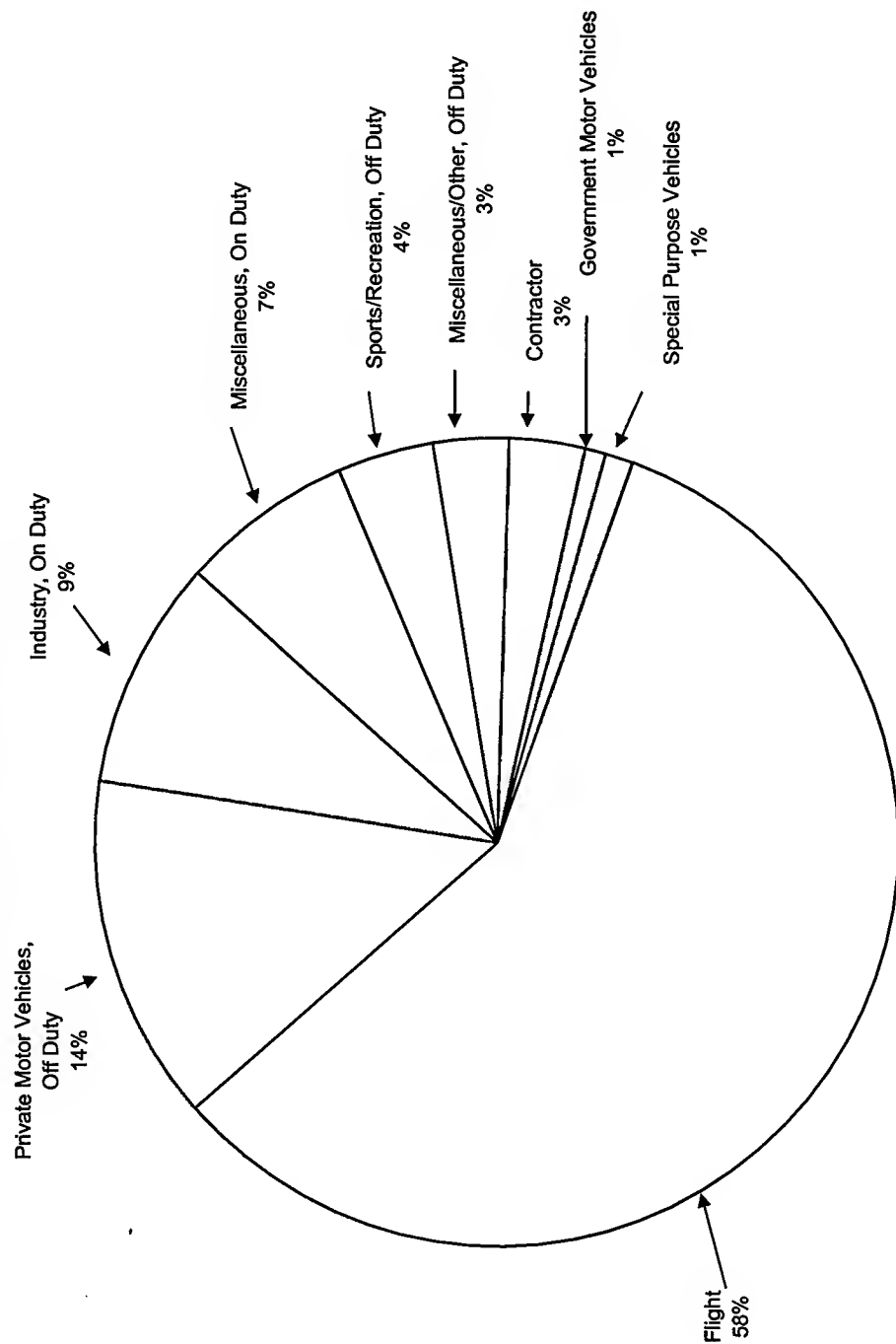
Figure 3-26

Figure 3-27 illustrates the distribution of Class A-C estimated costs of mishaps by type for Air Force active duty personnel for FY 1994. The top five mishaps account for 92% of the total cost:

- Flight—58% (\$75 million).
- Private motor vehicles, off duty—14% (\$18 million).
- Industry, on duty—9% (\$11 million).
- Miscellaneous, on duty—7% (\$9 million).
- Sports/recreation, off duty—4% (\$5 million).

The total cost of Class A-C accidents for FY 1994 was \$127 million.

Air Force - Distribution (%) of Class A-C* Estimated Costs of Mishaps by Type for Active Duty Personnel, FY 1994



Total cost = \$127 million.

* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B = Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C = Lost time; \$10K or more, but less than \$200K.

Source: Headquarters, Air Force Safety Agency (HQ AFSA/SEG), 1995.

Figure 3-27

Trends of Air Force Mishap Deaths and Overall Mishaps Relative to Other Causes Over Time.

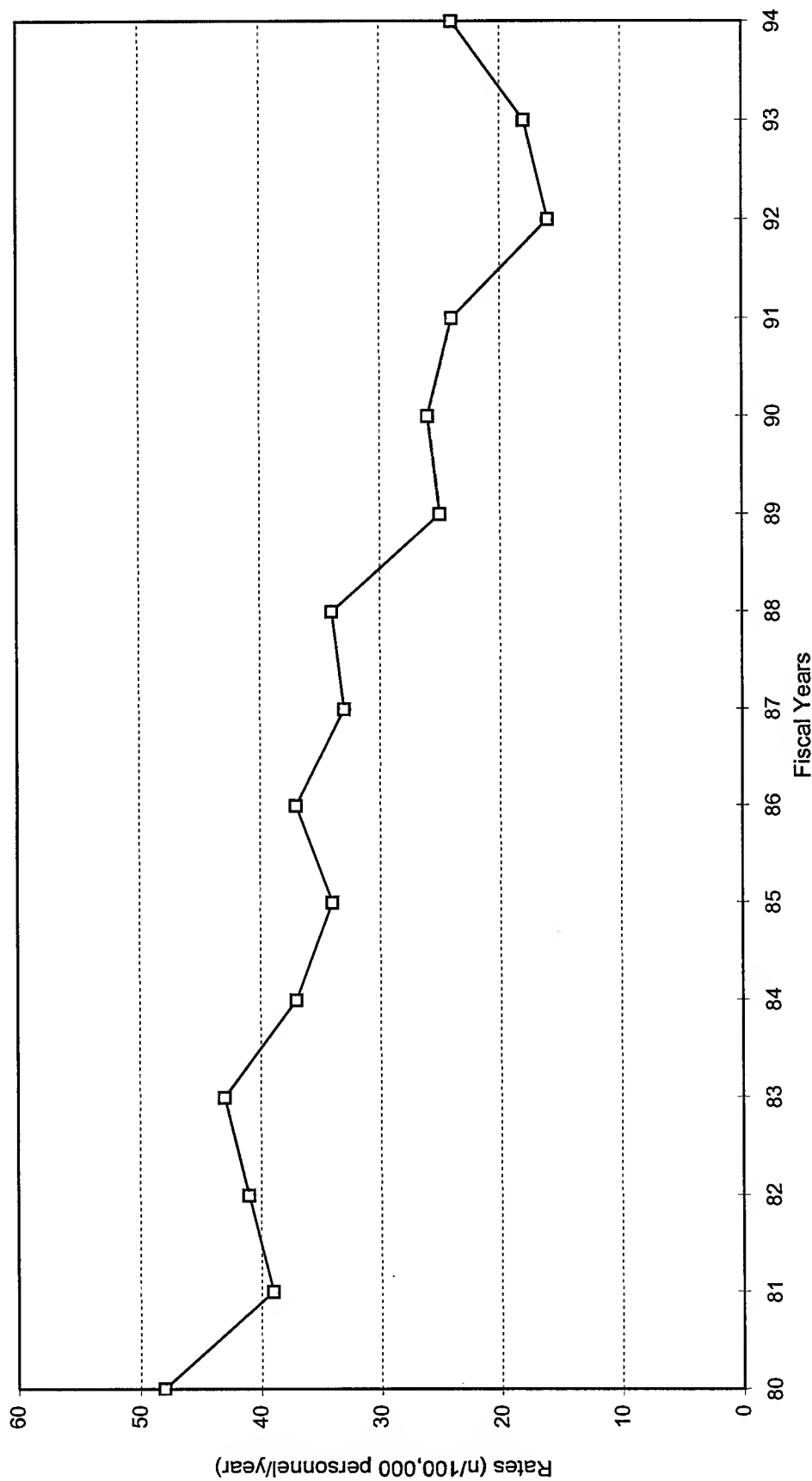
Figure 3-28 illustrates the rates of Class A ground mishaps (on and off duty) for active duty Air Force personnel for FY 1980-1994. Rates of accidental death decreased 50% from 48 per 100,000 personnel in FY 1980 to 24 per 100,000 personnel in FY 1994.

Worksheet Data for Figure 3-28

Air Force - Rates of Class A Ground Mishaps by Fiscal Year*															
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	48	39	41	43	37	34	37	33	34	25	26	24	16	18	24

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Air Force - Rates of Class A Ground Mishaps (On and Off Duty) for Active Duty Personnel,* FY 1980-1994†



* Data includes on and off duty personnel.
† 1992-1994 rates include fatalities only.

Numerator Source: 1980-1991: U.S. Air Force Mishap Bulletin; 1992-1994: Air Force Safety Center (HQ AFSC/SEG), 1995.
Denominator Source: DoD, DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95
(DTIC#: DIOR/M07-96/01). Washington, DC: WHS, DIOR.

Figure 3-28

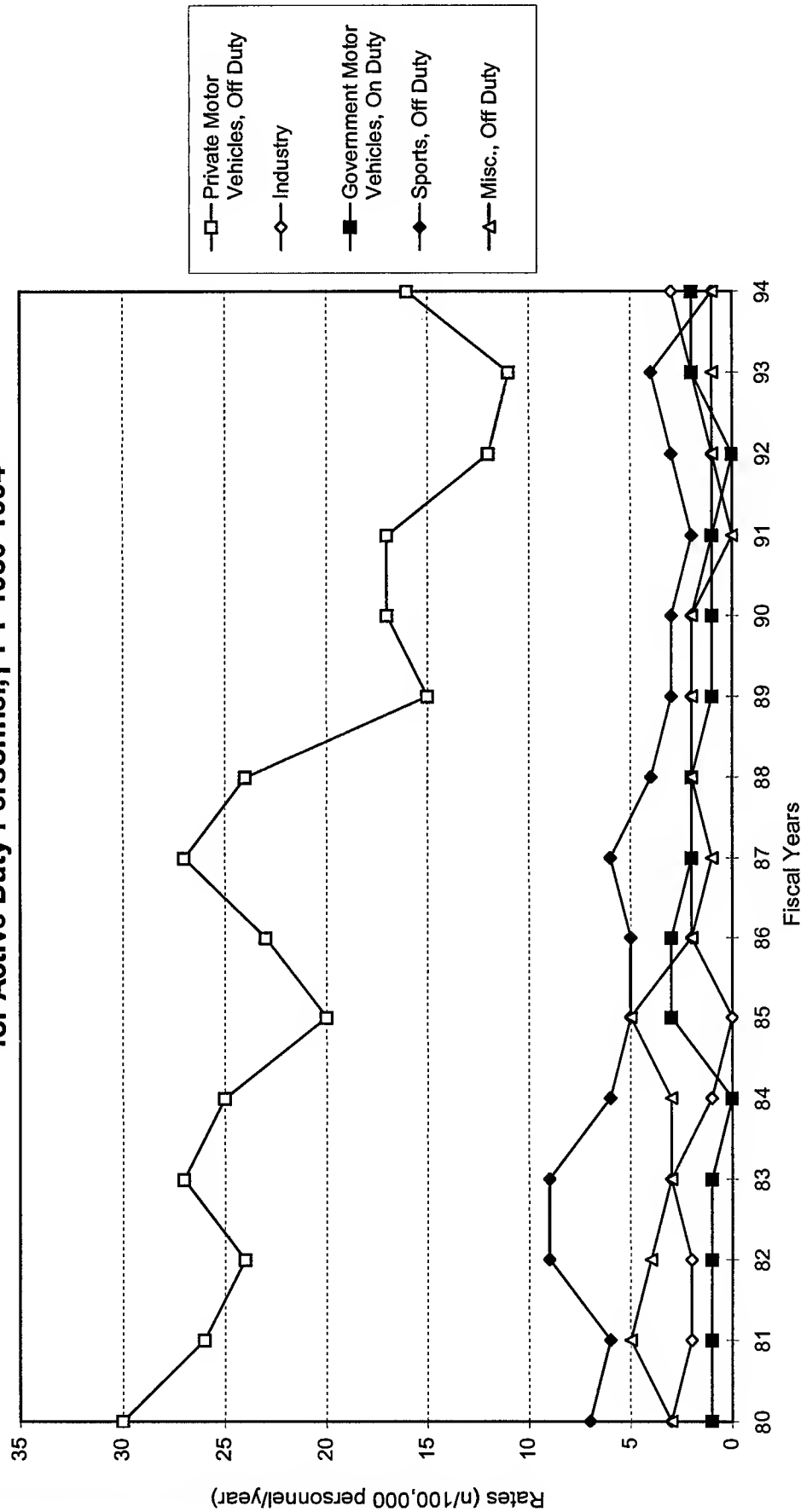
Figure 3-29 illustrates the rates of top five categories of Class A ground mishaps for active duty Air Force personnel for FY 1980-1994. Most notably, off duty private motor vehicle mishaps declined 47% from 30 per 100,000 personnel in FY 1980 to 16 per 100,000 personnel in FY 1994.

Worksheet Data for Figure 3-29

Top Five Categories of Class A Ground Mishaps (Rank Based on 1994 Data)		Air Force - Rates of Death by Fiscal Year*														
		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Private Motor Vehicles, Off Duty		30	26	24	27	25	20	23	27	24	15	17	17	12	11	16
Industry		3	2	2	3	1	0	2	2	2	2	2	1	1	2	3
Government Motor Vehicles, On Duty		1	1	1	1	0	3	3	2	2	1	1	1	0	2	2
Sports, Off Duty		7	6	9	9	6	5	5	6	4	3	3	2	3	4	1
Misc., Off Duty		3	5	4	3	3	5	2	1	2	2	2	0	1	1	1

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Air Force - Rates of Top Five Categories of Class A* Ground Mishaps for Active Duty Personnel,† FY 1980-1994



* Class A = Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

† 1992-1994 rates include fatalities only.

Numerator Source: 1980-1991: U.S. Air Force Mishap Bulletin; 1992-1994: Air Force Safety Center (HQ AFSC/SEG), 1995.
Denominator Source: DoD, DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95
(DTIC#: DIOR/M07-96/01). Washington, DC: WHS, DIOR.

Figure 3-29

Figure 3-30 illustrates the rates of Class A mishaps by private and government motor vehicles for active duty Air Force personnel for FY 1980-1994.

- Off duty fatality rates by private motor vehicles decreased 47% from 30 per 100,000 personnel in FY 1980 to 16 per 100,000 personnel in FY 1994.
- On duty fatality rates by government motor vehicles remained relatively constant during this period.

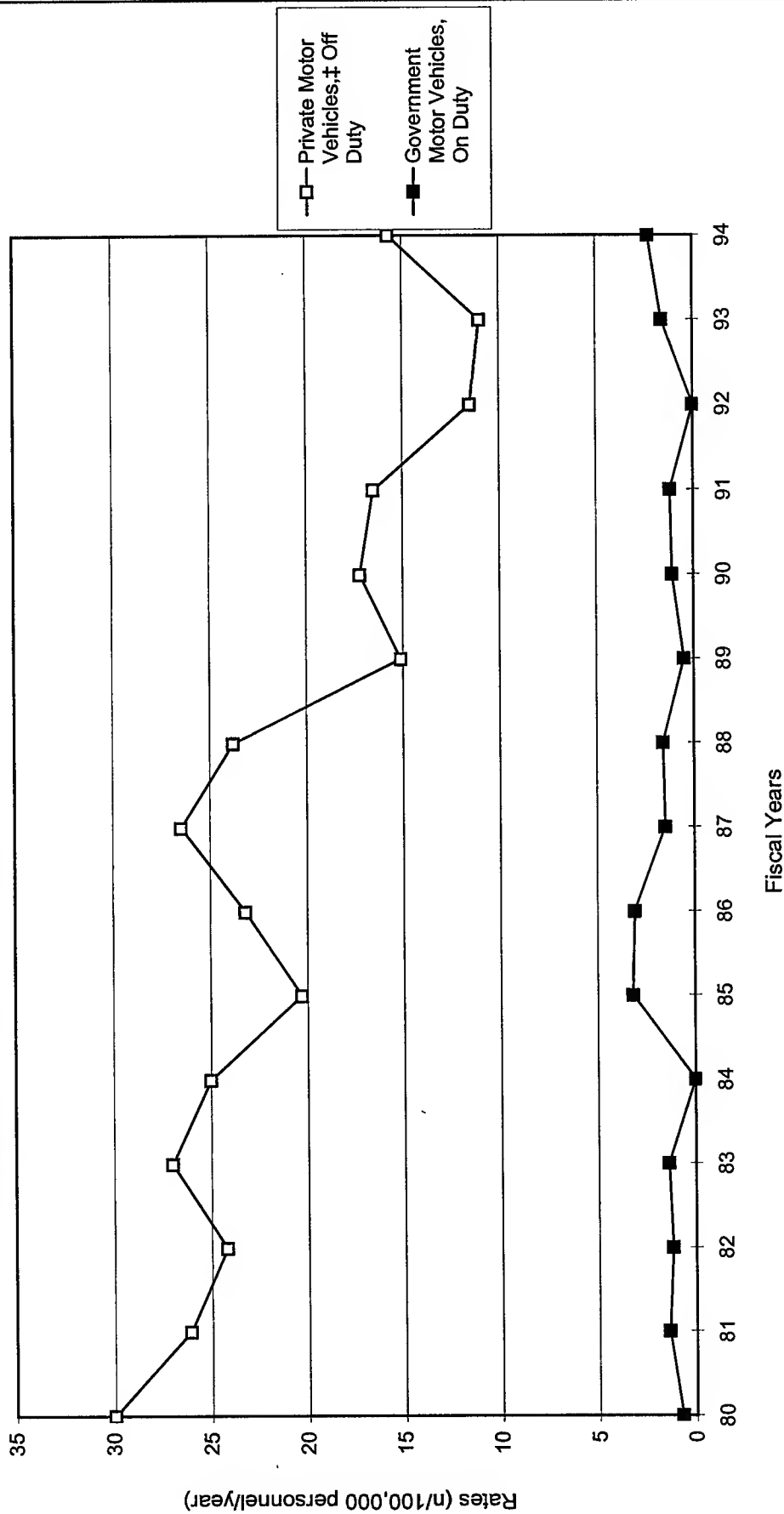
The significant decrease in private motor vehicle fatality rates is due to a combination of factors, including the Standard Traffic Safety Course and Local Conditions Course, as well as safety campaigns and strong commander emphasis.

Worksheet Data for Figure 3-30

Type of Vehicle	Air Force - Rates of Death by Fiscal Year*														
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	30	26	24	27	25	20	23	27	24	15	17	17	12	11	16
Private Motor Vehicles, Off Duty															
Government Motor Vehicles, On Duty	1	1	1	1	0	3	3	2	2	1	1	1	0	2	2

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Air Force - Rates of Class A* Mishaps by Private and Government Motor Vehicles for Active Duty Personnel, FY 1980-1994†



* Class A = Fatality or permanent disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

† FY 1992-1994 rates include fatalities only.

‡ FY 1980-1984 includes off duty private motor vehicle mishaps; FY 1985-1994 includes both on and off duty private motor vehicle mishaps.

Numerator Source: 1980-1991: U.S. Air Force Mishap Bulletin; 1992-1994: Air Force Safety Center (HQ AFSC/SEG), 1995.
 Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIORM07-96/01).

Figure 3-30

Figure 3-31 illustrates the rates of flight-related injuries and deaths for Air Force active duty personnel for FY 1990-1994.

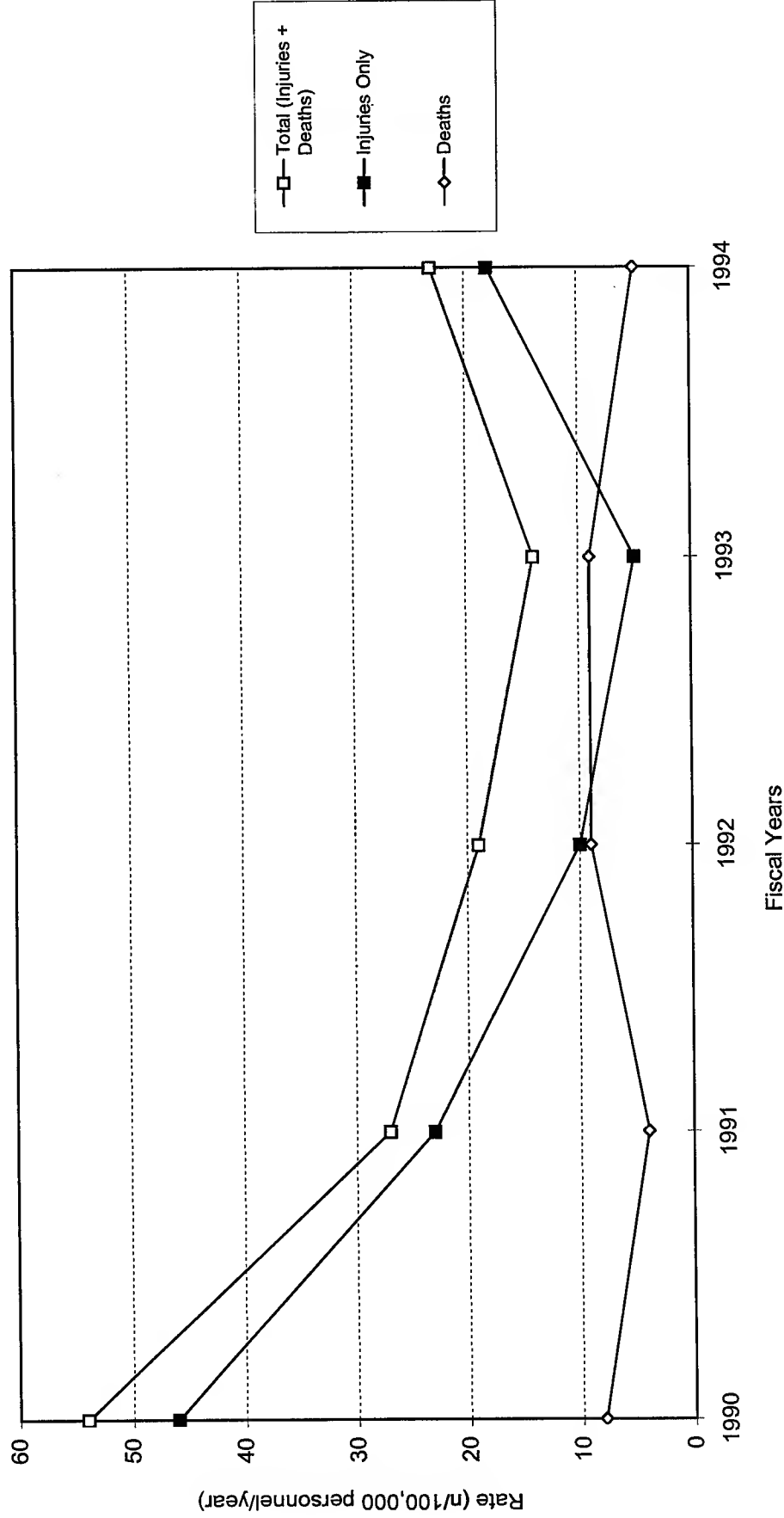
- Injuries and deaths combined decreased 57% from 54 per 100,000 personnel in FY 1990 to 23 per 100,000 personnel in FY 1994.
- Injuries decreased 61% from 46 per 100,000 personnel in FY 1990 to 18 per 100,000 personnel in FY 1994.
- Deaths decreased 38% from 8 per 100,000 personnel in FY 1990 to 5 per 100,000 personnel in FY 1994.

Worksheet Data for Figure 3-31

Flight-Related Injuries and Deaths	Air Force - Rates by Fiscal Year*				
	1990	1991	1992	1993	1994
Total (injuries + deaths)	54	27	19	14	23
Injuries	46	23	10	5	18
Deaths	8	4	9	9	5

* Rates per 100,000 personnel calculated using denominator data in Table 1-7.

Air Force - Rates of Flight-Related Injuries and Deaths for Active Duty Personnel, FY 1990-1994



Numerator Source: Air Force Safety Center (HQ AFSA/SEG), 1995.
 Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-95/01).

Figure 3-31

3-9. A Comparison of All Services

The safety center data for each service, presented in paragraphs 3-6 through 3-8, are compared and presented in two tables:

- **Table 3-13** compares the distribution of the top five causes of death by accident/mishap type for military and active duty personnel for FY 1994.
- **Table 3-14** compares the distribution and costs of the top five causes of accidents/mishaps by type for military and active duty personnel for FY 1994.

**Table 3-13. Distribution (%) of Top Five Causes of Death by Accident/Mishap Type for Military* and Active Duty Personnel, FY 1994—
A Comparison of All Services**

Accident/Mishap Type	Distribution (%) and Rank Order of Top Five Causes of Death										Conclusion
	Army		Navy		Marine Corps		Air Force				
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	
Privately Owned Vehicles	59%	1	64%†	1	61%†	1	55%	1	55%	1	Privately owned motor vehicle crashes are the leading cause of death for all services, accounting for well over 50% of all fatalities.
Government Motor Vehicles Motor/Wheeled Combat/Tracked	—	—	—	—	—	—	—	—	5%	4	
	3%	4	—	—	—	—	—	—	—	—	
	3%	4	—	—	—	—	—	—	—	—	
Personnel Injuries	12%	2	—	—	—	—	—	—	—	—	
Aviation/Flight	5%	3	8%	3	3%	3	18%	2	18%	2	
Training/Operations	—	—	—	—	10%	2	—	—	—	—	
Industrial	—	—	—	—	1%	4	8%	3	8%	3	
Shore/Recreational/Sports†	—	—	19%	2	—	—	5%	4	5%	4	
Shore Operational§	—	—	4%	4	—	—	—	—	—	-	
Afloat	—	—	4%	4	—	—	—	—	—	—	
Other Nonoperational	—	—	—	—	25%	5	—	—	—	—	

* Data includes active duty, Reserve, and National Guard.

† Includes occupants in four-wheel vehicles, motorcycle riders, pedestrians, and bicyclists struck by a vehicle.

‡ Shore/Recreational includes all recreational mishaps plus all off-duty shore mishaps that are not motor vehicle accidents.

§ Shore Operational includes operational mishaps that are not aviation, afloat, or government motor vehicle.

Table 3-14. Distribution (%) and Costs of Top Five Causes of Accidents/Mishaps by Type for Military* and Active Duty Personnel, FY 1994—A Comparison of All Services

Distribution (%) by Estimated Cost (Million)										Conclusions
Accident/Mishap Type	Army		Navy		Marine Corps		Air Force			
	%	Cost (Million)	%	Cost (Million)	%	Cost (Million)	%	Cost (Million)		
Privately Owned Vehicles	35%	\$32	5%	\$22	8%	\$16	14%	\$19	• Aviation and privately owned vehicle accidents/mishaps are in the top five most costly injury categories for all services. • Aviation accident/mishap costs are greatly influenced by the cost of aircraft systems. • Direct intra-service cost comparisons should be done cautiously. Differences in reporting criteria, methods for estimating costs, and the relative proportions of Reserve and National Guard accident/mishap costs included may vary in the data provided for this illustration.	
Personnel Injuries	34%	\$31	—	—	—	—	—	—		
Aviation	12%	\$11	81%	\$381	84%	\$165	58%	\$75		
Military Vehicles Wheeled/Motor Tracked/Combat	3% 2%	\$3 \$2	— —	— —	— —	— —	— —	— —		
Miscellaneous/Other, Off Duty	14%	\$13	—	—	—	—	—	—		
Miscellaneous, On Duty	—	—	—	—	—	—	7%	\$9		
Shore/Recreational	—	—	3%	\$14	—	—	—	—		
Shore Operational	—	—	5%	\$25	—	—	—	—		
Training/Operations	—	—	—	—	—	—	—	—		
Afloat	—	—	5%	\$25	—	—	—	—		
Other Nonoperational	—	—	—	—	—	—	—	—		
Industry, On Duty	—	—	—	—	—	—	9%	\$11		
Sports/Recreation, Off Duty	—	—	—	—	—	—	4%	\$5		
TOTAL COST	—	\$92	—	\$467	—	\$201	—	\$119		

* Data includes active duty, Reserve, and National Guard.

CHAPTER 4

Disabilities Related to the Musculoskeletal System: Physical Evaluation Board Data

Paul J. Amoroso, MD, MPH, and Michelle L. Canham, MPH

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Section I. Description of Service Disability Agency Databases

4-1. Introduction

- The Army disability data are maintained on the Physical Disability Case Processing System (PDCAPS) at Walter Reed Army Medical Center, Forest Glenn Annex, Washington, D.C.
- The Navy and Marine Corps disability data are maintained on the Physical Evaluation Tracking System (PETS) at the Naval Council of Personnel Boards, Washington Navy Yard, Washington, D.C. In addition, Navy MEB data are maintained at the Navy Medical Information Management Center, Bethesda, Maryland.
- The Air Force disability tracking file is a subsystem maintained on the Headquarters Air Force Personnel Data System (PDS) at the Air Force Military Personnel Center, Randolph Air Force Base, Texas.

4-2. Mission

The mission of each service's disability agency is to:

- Maintain a fit and vital fighting force by discharging from active duty those personnel who can no longer perform their duties due to physical disability.
- Fairly compensate members whose military service produced or aggravated disability.

Data collection, case tracking, analysis, and archiving in the service databases support that mission.

4-3. Purpose of Disability Databases

- Army.
 - Document and track the progress of disability evaluations, cases, and disposition.
 - Retain summary statistics.

- Navy and Marine Corps.
 - Analyze PEB processing times, functionality, and process and outcome costs.
 - Track the status of individual cases.
 - Provide statistics—such as demographics, ICD-9 codes, VASRD codes, percentage ratings, and dispositions—in response to internal and external inquiries.
- Air Force.
 - Track case files through the disability evaluation process.
 - Record recommended final disposition of various disability evaluation boards.
 - Track personnel, schedule evaluations, and monitor personnel on Temporary Disability Retired Lists (TDRLs).*
 - Provide status and recommendations of other boards to officials involved with disability processing.

4-4. Authority

The authority for generating databases to support the disability agencies is derived from:

- Title 10, U.S. Code, Section 1201-1206.
- Title 38, CFR, Part 4, Schedule for Rating Disabilities.
- DoD Directive 1332.18—Separation or Retirement for Physical Disability.

Each service may have additional requirements as outlined in their own governing documents:

- Army—AR 635-40, Physical Evaluation for Retention Retirement or Separation.
- Navy and Marine Corps—SECNAVINST 1850.4c and 1770-3a, and NAVMED P-117.
- Air Force—AF Form 348, Line of Duty and Misconduct Status.

*The TDRL is used in the nature of a “pending list.” It provides a safeguard for the government against permanently retiring a soldier who can later fully recover, or nearly recover, from the disability causing him/her to be unfit. Conversely, the TDRL safeguards the soldier from being permanently retired with a condition that may reasonably be expected to develop into a more serious permanent disability.

4-5. Comparison of Minimum Basic Data Set Variables and U.S. Military Disability Databases

Each service identified their database's disability variables for *unintentional injuries* using the questionnaire discussed in Chapter 1 (see pages 1-23 through 1-27). These variables were compared to the MBDS for unintentional injury surveillance recommended by Lund, Holder, and Smith.* A comparison is presented in Table 4-1.

The services were not asked to identify their database's injury variables for *intentional injuries*.† Additional data required to satisfy the MBDS for intentional injuries include circumstances or motive surrounding injury event, drugs or alcohol involved, weapon(s) involved, relationship and demographics of victim and perpetrator, and source of data.

* Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994.

† Powell, K. and J. Kraus. Minimum Basic Data Set, Intentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:35-1 to 35-2, 1994.

Table 4-1. Comparison of the Recommended Elements for the Minimum Basic Data Set for Unintentional Injury Surveillance to the U.S. Military Disability Databases

Variables	Army Physical Disability Agency	Navy and Marine Corps Physical Evaluation Board	Air Force Physical Disability Division
Intent*	Y	Y	Y
Age of Injured*	Y	Y	N
Gender*	Y	Y	N
Race*	Y	Y	N
Place of Residence*	U	U	U
Date of Injury Event*	N	N	N
Place of Occurrence (e.g., home, work, etc.)*	N	N	N
Address of Place of Occurrence*	NS	NS	NS
Activity When Injury Occurred*	N	Y	N
Mechanism of Accident/ Event*	N	Y	N
Type of Injury/Body Location*	Y	Y	Y
Outcome of Injury			
Type of Treatment†	N	N	N
Dates of Treatment†	N	N	N
Date Admitted to Hospital†	N	N	N

Table 4-1.—Continued

Variables	Army Physical Disability Agency	Navy and Marine Corps Physical Evaluation Board	Air Force Physical Disability Division
Date Discharged from Hospital†	N	N	N
Nature of Disability†	N	Y	N
Degree of Disability (fit for duty, TDRL, etc.) †	Y	Y	Y
Severity of Injury†	N	Y	N
Days of Limited Duty†	N	N	N
Days in Hospital†	N	N	N
Costs of Treatment†	N	N	N

Y = available in database.

N = not in database.

U = unknown; response not provided on questionnaire.

NS = not solicited on questionnaire.

* Recommended variables for databases designed for unintentional injury surveillance (Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994).

† Example of an outcome variable deemed appropriate for databases with potential for surveillance of unintentional injuries to U.S. active duty military and civilian personnel.

Section II. Disability Data

4-6. Army

The Army disability data are presented in five parts:

- The Army Summary. The Army disability data presented in this section are summarized in three tables.
 - The overall summary is presented in Table 4-2.
 - The data in figures 4-1 and 4-2 are summarized in Table 4-3.
 - The data in figures 4-7 and 4-8 are summarized in Table 4-4.
- Magnitude of the Injury Problem Relative to Other Causes of Disability.
 - The distribution of disabilities by groups of VASRD codes and individual VASRD codes for FY 1994 is displayed in figures 4-1 and 4-2.
 - The distribution of MEB findings for one infantry division for CY 1994 is displayed in figures 4-3 and 4-4.
- Trends of Army Injury-Related Disabilities Relative to Other Causes Over Time. The rates of physical disability evaluations for FY 1983-July 1994 are displayed in Figure 4-5.
- Case Distributions. The distribution of all disability dispositions for FY 1994 is displayed in Figure 4-6. The distribution of all disability dispositions for FY 1993 is displayed in Figure 4-7.
- Costs of Disabilities. The projected lifetime costs of disabilities by disability dispositions for FY 1993 are displayed in Figure 4-8.

The Army Summary.

Table 4-2. Overall Summary of Army Disability Data for Active Duty Personnel

Year	Total Army Population	Disability Cases		Rates and Trends of Disabilities		Conclusion
		Total	n/1,000 Personnel/Year	n/1,000 Personnel/Year	Trend, % Change (FY 1983-1994)	
FY83-FY94	—	—	—	8/FY83	15/FY94	Disability cases nearly doubled from FY 1983 to 1994.
FY93	572,423	9,903	17	—	—	
FY94	541,343	6,382	12	—	—	

Table 4-3. Summary of Army Disability Data by VASRD Codes,* FY 1994

Disabilities	Distribution (%) of Disabilities		Conclusions
	Groups of Two-Digit Codes	Individual Two-Digit Codes	
50-53: Musculoskeletal (Orthopedic)			<p>Musculoskeletal (Orthopedic)</p> <ul style="list-style-type: none"> As the leading cause of disabilities, musculoskeletal (orthopedic) conditions occur more than three times as often as mental disorders, the second leading cause. In CY 1994, a study of one infantry division showed that 40% of the MEB findings were musculoskeletal (orthopedic)-related injuries (see Figure 4-3). <p>Other Impairment to Bones & Bone and Joint Diseases</p> <ul style="list-style-type: none"> As contributors to the musculoskeletal (orthopedic) codes, codes 50 and 52 account for over half of all disabilities. <p>Mental Disorders & Neurological /Convulsive</p> <ul style="list-style-type: none"> Mental disorders and neurological conditions/convulsive disorders are the second and third leading causes of disabilities, respectively.
52: Other Impairment to Bones	53.1%	—	
50: Bone and Joint Diseases	—	35.0% 16.8%	
90-95: Mental Disorders	14.2%	—	
92: Psychotic Disorders	—	8.3%	
94: Psychoneurotic Disorders	—	4.3%	
93: Organic Brain Disorders	—	1.5%	
80-89: Neurological/Convulsive	12.1%	—	
80: Organic Disease of the Central Nervous System	—	5.3%	
85: Peripheral Nerves: Paralysis	—	2.4%	
89: Epilepsies	—	1.8%	
81: Neurological Conditions	—	1.8%	
63-68: Systemic/Respiratory	7.4%	—	
63: Systemic Diseases	—	4.1%	
66: Trachea and Bronchi	—	1.9%	
70-71: Cardiovascular	3.4%	—	
70: Heart	—	2.2%	
71: Arteries and Veins	—	1.2%	
77-79: Blood/Skin/Endocrine	3.3%	—	
77: Hemic and Lymphatic Systems	—	1.4%	
72-73: Digestive	2.9%	—	
73: Digestive System	—	2.9%	
60-62: Visual/Auditory	1.6%	—	
75-76: Genitourinary/Gynecological	1.4%	—	

* Codes as defined in 38 CFR 4.

Table 4-4. Summary of Army Disability Dispositions and Costs, FY 1993

Disability Dispositions	Projected Lifetime Costs*			Conclusions
	Distribution (%) of Dispositions (n = 9903)	Total Disability Compensation		
		Distribution of Costs (%)	Estimated Costs (million)	
Permanent Disability <ul style="list-style-type: none">Unfit by virtue of a permanent and stable compensable physical disability, with at least 20 years service <i>or</i> minimum disability rating of 30% under the VASRD.Individual receives payments for the rest of his/her life.	15%	84%	\$407.4	Permanent Disability <ul style="list-style-type: none">Only 15% of the cases accounted for 84% (\$407.4 million) of the total disability lifetime compensation costs for FY 1993.
Temporary Disability <ul style="list-style-type: none">Condition not stable (VASRD rating could change over time).0-100% disability under the VASRD with over 20 years' service.30-100% disability under the VASRD with less than 20 years' service.Reevaluate VASRD every 18 months, at a minimum.Individual can be on temporary disability retirement no more than 5 years.	17%	4%	\$19.4	Temporary Disability <ul style="list-style-type: none">Only makes up a small portion of total costs because these cases do not accumulate over time as they do in categories such as permanent disability.
Separation with Severance Pay <ul style="list-style-type: none">Unfit by virtue of physical disability.Less than 20 years' service and disability is rated at 0-30% under the VASRD.Stability of medical condition is not a factor for this disposition.Total lifetime disability compensation cost is represented by a one-time separation payment.	43%	12%	\$58.2	Separation with Severance Pay <ul style="list-style-type: none">Accounts for 43% of all the disability dispositions in FY 1993, but only 12% (\$58.2 million) of the total lifetime disability compensation costs because it's a one-time cost to the Army.
Separation with No Benefits <ul style="list-style-type: none">Unfit by virtue of a disability incurred as a result of intentional misconduct, willful neglect, or during unauthorized absence; <i>or</i>Disability existed prior to service and not permanently aggravated by service.	4%	—	—	
Fit for Duty <ul style="list-style-type: none">Medical condition does not interfere with reasonable performance of duties of office, grade, rank, or rating.	21%	—	—	

*The Army estimates the lifetime cost of its FY 1993 disability cases to total \$485 million.

Magnitude of the Injury Problem Relative to the Other Causes of Disabilities.

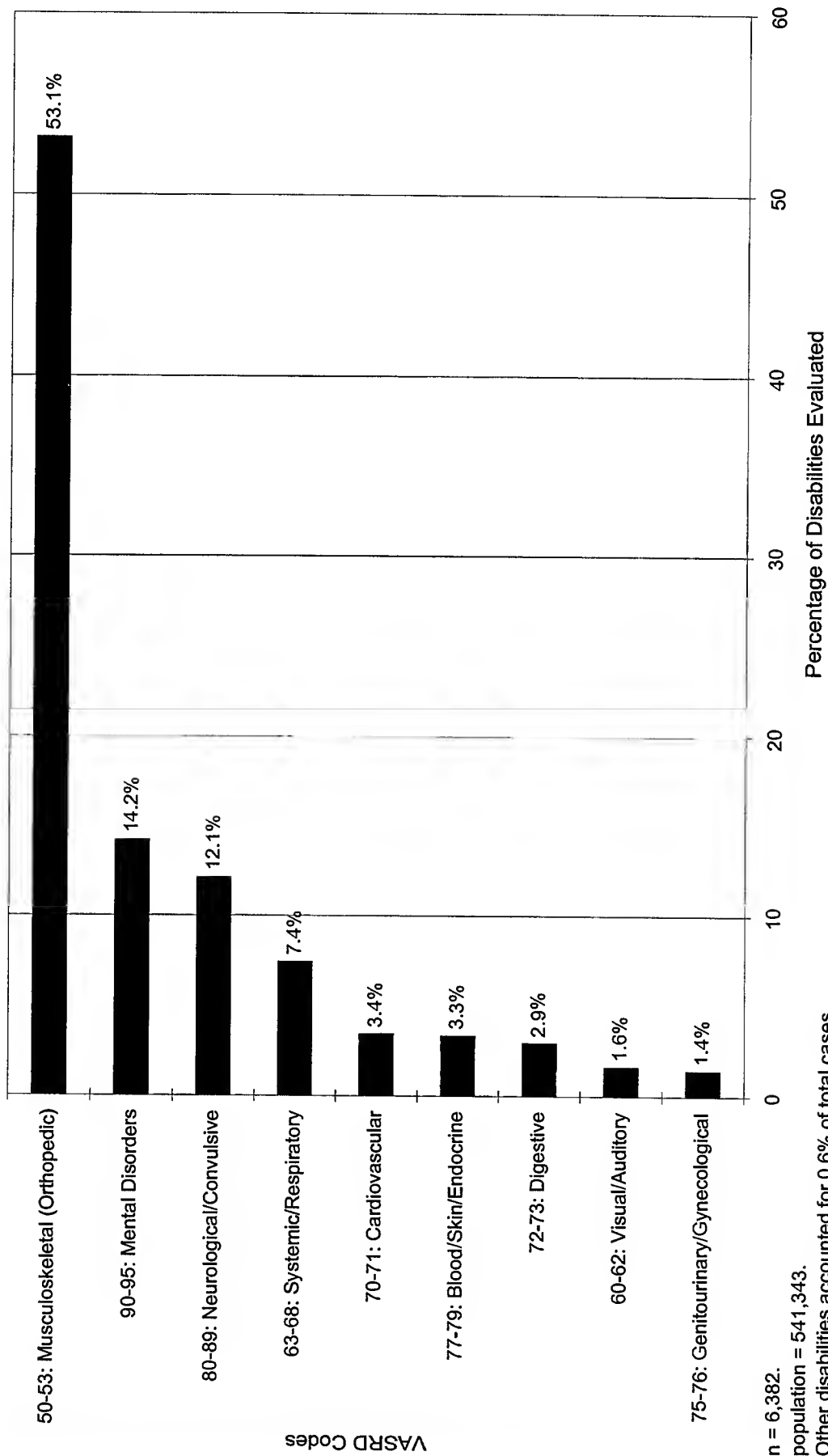
Figure 4-1 illustrates the distribution of disabilities by two-digit VASRD codes for Army personnel for FY 1994. Cases represented here are only those that received a disability disposition. The top five codes were:

- Musculoskeletal (orthopedic)—53.1%.
- Mental disorders—14.2%.
- Neurological/convulsive—12.1%.
- Systemic/respiratory—7.4%.
- Cardiovascular—3.4%.

Disabilities due to musculoskeletal conditions are largely related to injuries and their sequelae. Musculoskeletal (orthopedic) conditions are the leading cause of disabilities and occur more than three times as often as mental disorders, the second leading cause of disabilities. The total number of disabilities for FY 1994 was 6,382, out of a population of 541,343, or about 12 disabilities per 1,000 personnel.

Some of the neurological conditions and mental disorders such as brain disease due to trauma (VASRD code 8045), paralysis (VASRD codes 8510-8530), and some brain disorders (VASRD code 9304) may be associated with brain trauma.

Army - Distribution (%) of Disabilities by Two-Digit VASRD Codes,* FY 1994



Source: U.S. Army Physical Disability Agency, Walter Reed Army Medical Center, Forest Glen Annex, Washington, DC, February 1996.

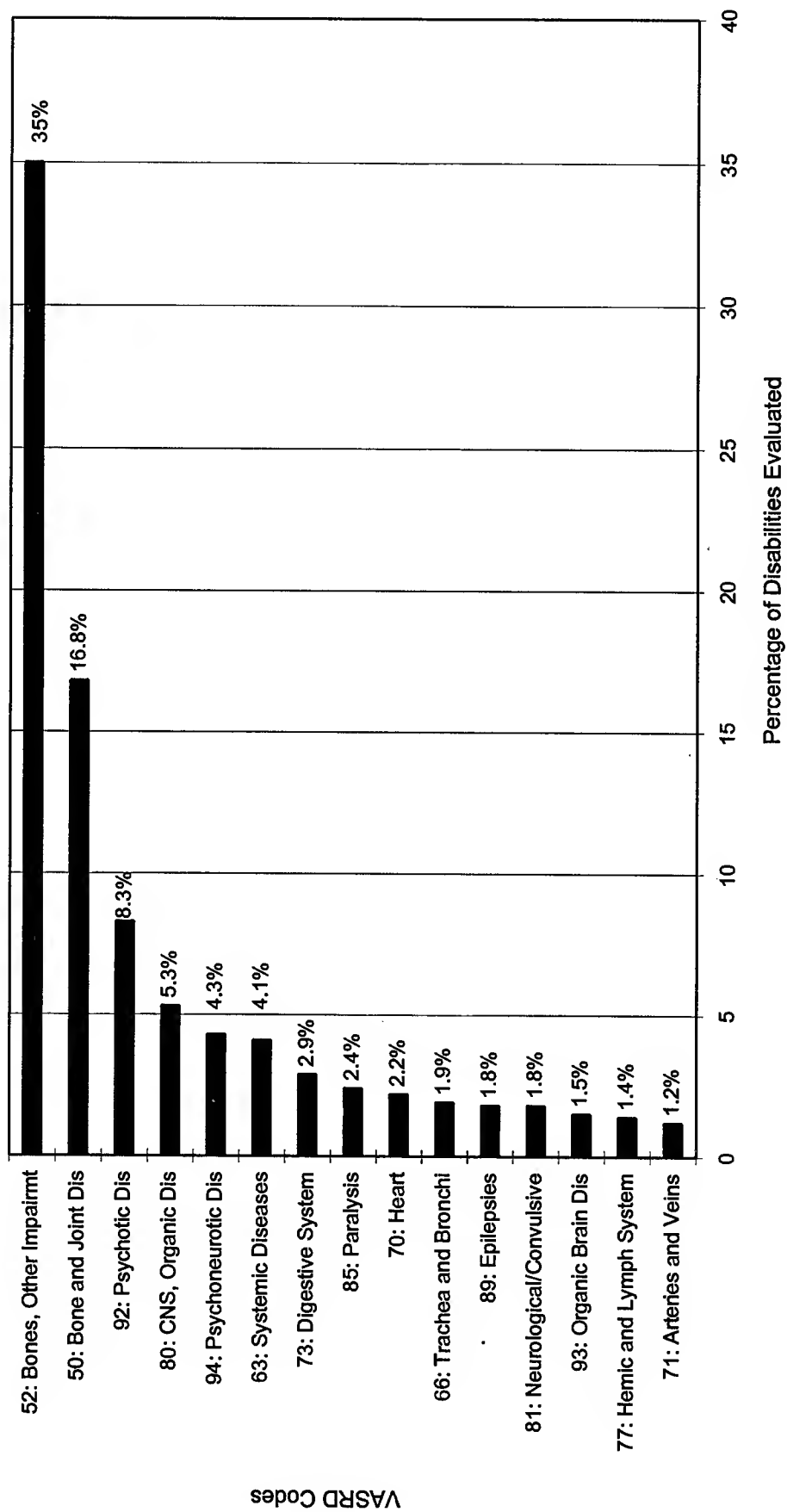
Figure 4-1

Figure 4-2 illustrates the distribution of the top 15 disabilities by two-digit VASRD codes for Army personnel for FY 1994. Cases represented here are only those that received a disability disposition. The top five codes were:

- Other impairment to bones—35%.
- Bone and joint diseases—16.8%.
- Psychotic disorders—8.3%.
- Organic disease of the central nervous system—5.3%.
- Psychoneurotic disorders—4.3%

Other impairment to the bones and bone and joint disease, which contribute to the musculoskeletal (orthopedic) code noted in Figure 4-1, account for over half of all disabilities.

Army - Distribution (%) of Top 15 Disabilities by Two-Digit VASRD Codes,* FY 1994



n = 6,382.

* VASRD codes as defined in 38 CFR 4.

Source: U.S. Army Physical Disability Agency, Walter Reed Army Medical Center, Forest Glen Annex, Washington, DC, February 1996.

Figure 4-2

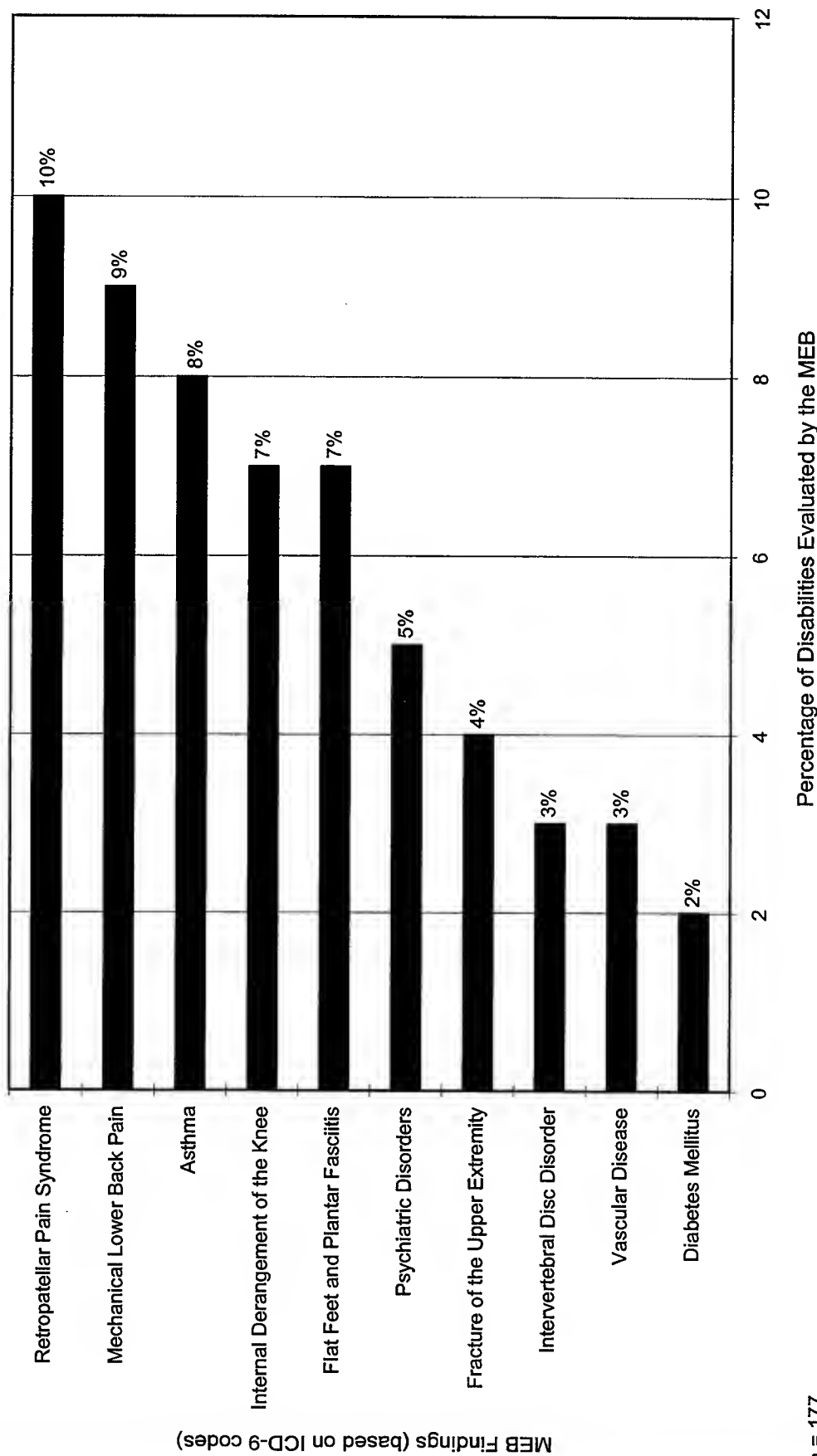
Medical Evaluation Board Data for an Army Infantry Division

Figure 4-3, a study of the distribution of the top 10 MEB findings for an infantry division in CY 1994, illustrates that 40% of the cases appear to be musculoskeletal (orthopedic)-related injuries:

- Retropatellar pain syndrome—10%.
- Mechanical lower back pain—9%.
- Internal derangement of the knee—7%.
- Flat feet and plantar fasciitis—7%.
- Fracture of the upper extremity—4%.
- Intervertebral disc disorder—3%.

These MEB findings for a single infantry division are consistent with the PEB findings in Figure 4-1 for the total Army. In both instances, musculoskeletal (orthopedic) conditions are the leading cause of disabilities.

Army - Distribution (%) of Top 10 Medical Evaluation Board Findings for an Infantry Division,* CY 1994



n = 177.

* Other = 42% of total.

Source: "Army Injury Surveillance: The Medical Evaluation Board and Line of Duty Investigation as Potential Data Sources," briefing by Gregory L. Page, DO, MPH, 8 August 1995.

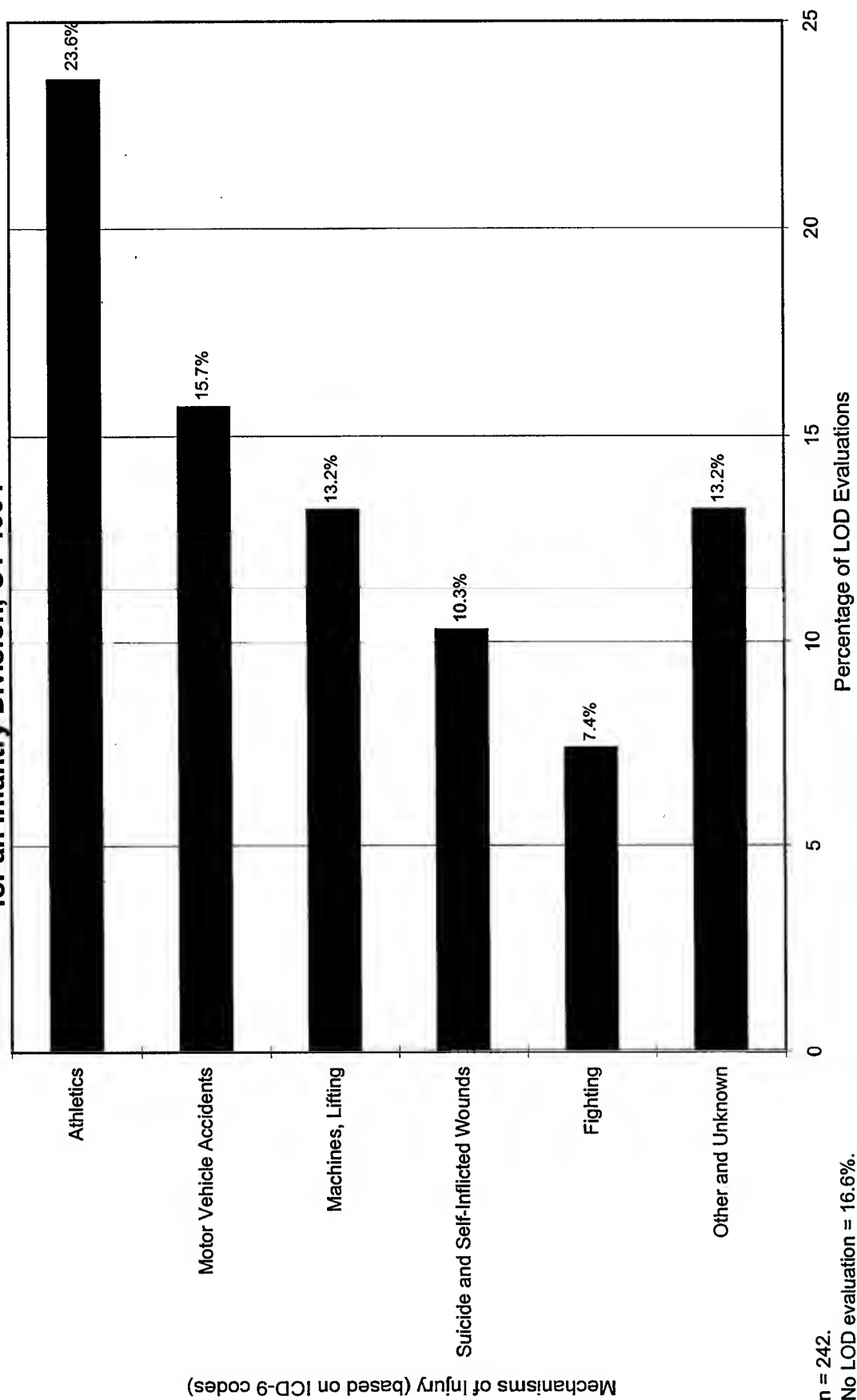
Figure 4-3

Line of Duty Evaluations for an Army Infantry Division

Figure 4-4 illustrates the distribution of mechanisms of injury from line of duty (LOD) evaluations for the same infantry division cited in Figure 4-3, also for CY 1994. The data show the following distribution of injuries:

- Athletics—23.6%
- Motor vehicle accidents—15.7%.
- Machines, lifting—13.2%.
- Suicide and self-inflicted wounds—10.3%.
- Fighting—7.4%.
- Other and unknown—13.2%.

Army - Distribution (%) of Mechanisms of Injury from Line of Duty Evaluations for an Infantry Division, CY 1994



Source: "Army Injury Surveillance: The Medical Evaluation Board and Line of Duty Investigation as Potential Data Sources," briefing by Gregory L. Page, DO, MPH, 8 August 1995.

Figure 4-4

Trends of Army Injury-Related Disabilities Relative to Other Causes Over Time.

Figure 4-5 illustrates the rates of physical disability cases in the Army Physical Disability Evaluation System during FY 1983-1994. These rates are typically used to measure the incoming workload. For various reasons, not all cases are evaluated and given a final disposition.

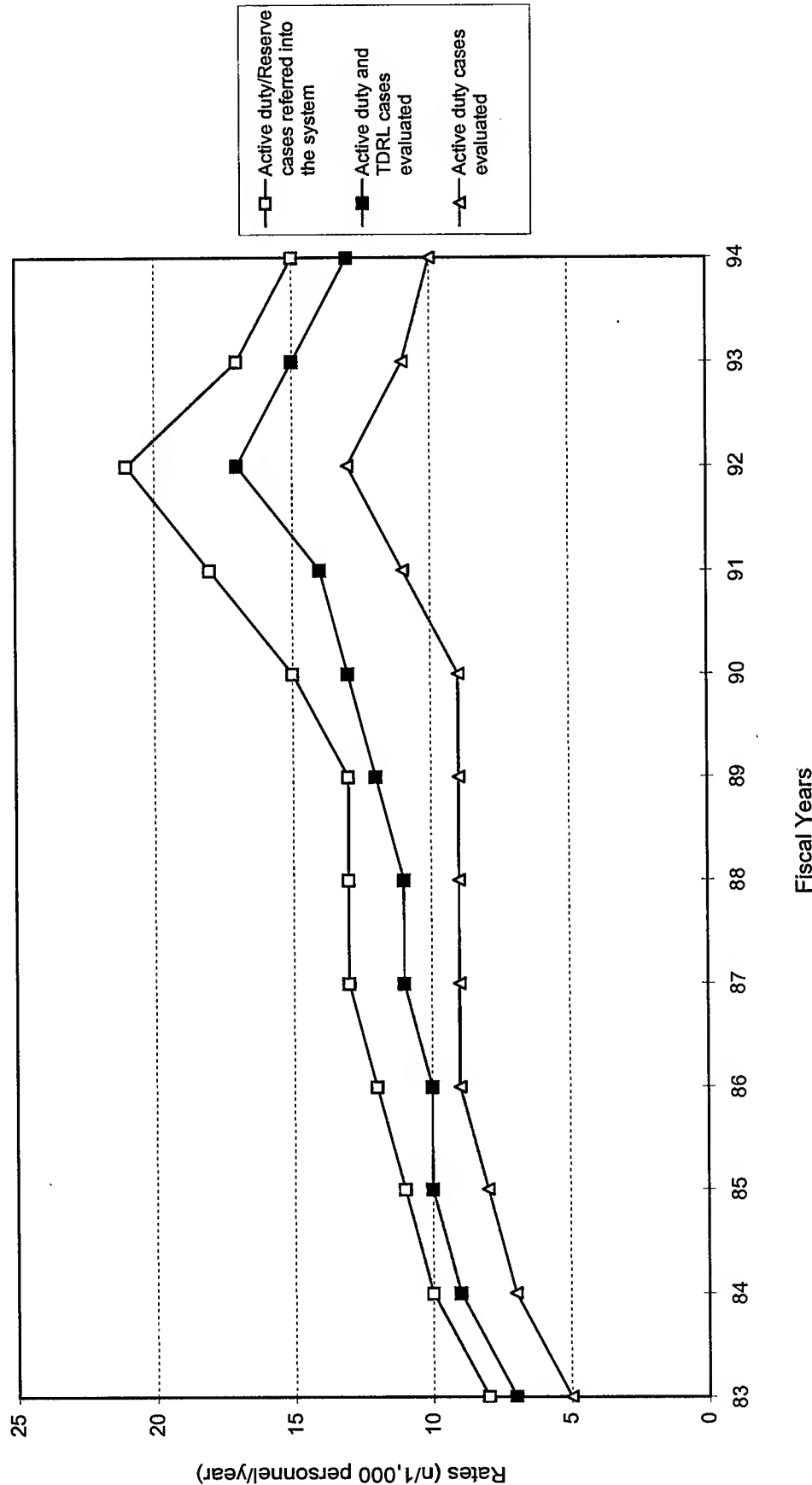
- Active duty/Reserve cases referred into the system:
 - Increased 163% from 8 cases per 1,000 active duty personnel in FY 1983 to a high of 21 cases per 1,000 active duty personnel in FY 1992.
 - Decreased 40% from 21 cases per 1,000 active duty personnel in FY 1992 to 15 cases per 1,000 active duty personnel in FY 1994.
- Active duty/TDRL cases evaluated:
 - Increased 143% from 7 cases per 1,000 active duty personnel in FY 1983 to a high of 17 cases per 1,000 active duty personnel in FY 1992.
 - Decreased 24% from 17 cases per 1,000 active duty personnel in FY 1992 to 13 cases per 1,000 active duty personnel in FY 1994.
- Active duty cases evaluated:
 - Increased 160% from 5 cases per 1,000 active duty personnel in FY 1983 to a high of 13 cases per 1,000 active duty personnel in FY 1992.
 - Decreased 23% from 13 cases per 1,000 active duty personnel in FY 1992 to 10 cases per 1,000 active duty personnel in FY 1994.

Worksheet Data for Figure 4-5

Physical Disability Cases	Army - Rates of Physical Disability Evaluations by Fiscal Year*											
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Active Duty/Reserve—Referred	8	10	11	12	13	13	13	15	18	21	17	15
Active Duty/TDRL—Evaluated	7	9	10	10	11	11	12	13	14	17	15	13
Active Duty—Evaluated	5	7	8	9	9	9	9	9	11	13	11	10

* Rates per 1,000 personnel calculated using denominator data in Table 1-7.

Army - Rates of Physical Disability Cases in the Army Physical Disability Evaluation System,* FY 1983-1994



* Reserve and National Guard cases may be included in the numerator while not adequately reflected in the denominator (rates could be overestimated).

Numerator Source: U.S. Army Physical Disability Agency, Walter Reed Army Medical Center, Forest Glen Annex, Washington, DC, February 1996.

Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD,

Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

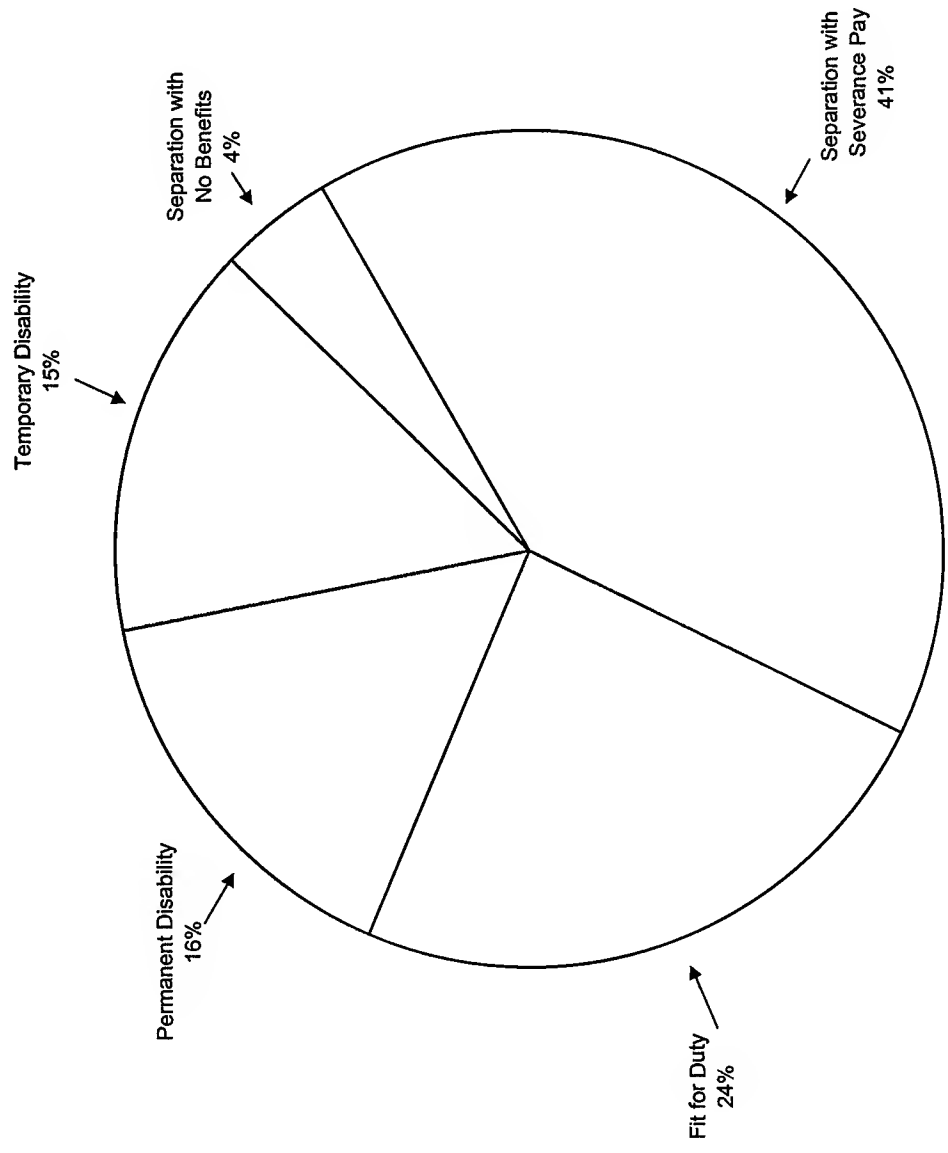
Figure 4-5

Case Distributions.

Figure 4-6 illustrates the distribution of 8,413 Army disability dispositions (cases reviewed) for FY 1994:

- Separation with severance pay—41%.
- Fit for duty—24%.
- Permanent disability—16%.
- Temporary disability—15%.
- Separation with no benefits—4%.

Army - Distribution (%) of Disability Dispositions (Cases Reviewed), FY 1994



n = 8,413.

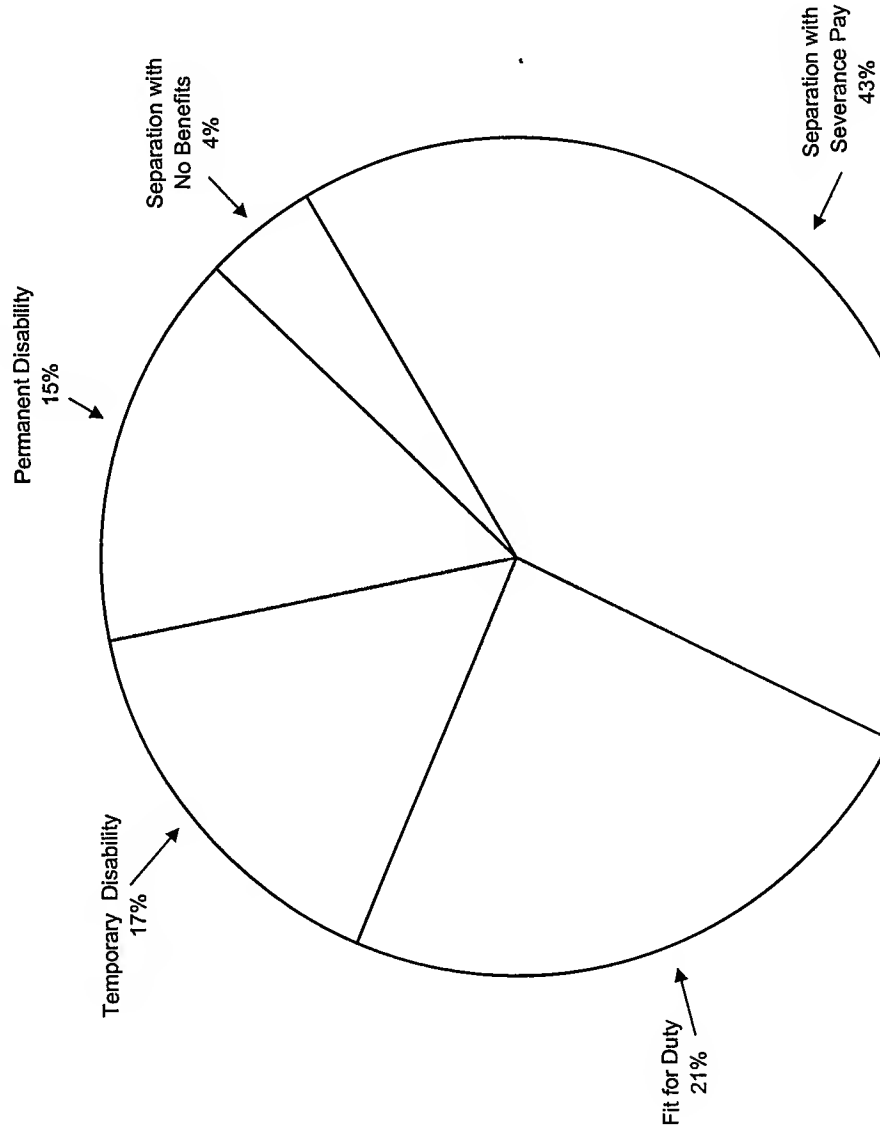
Source: U.S. Army Physical Disability Agency, Walter Reed Army Medical Center, Forest Glen Annex, Washington, DC, February 1996.

Figure 4-6

Figure 4-7 illustrates the distribution of 9,903 Army disability dispositions (cases reviewed) for FY 1993:

- Separation with severance pay—43%.
- Fit for duty—21%.
- Temporary disability—17%.
- Permanent disability—15%.
- Separation with no benefits—4%.

Army - Distribution (%) of Disability Dispositions (Cases Reviewed), FY 1993



n = 9,903.

Source: U.S. Army Physical Disability Agency, Walter Reed Army Medical Center, Forest Glen Annex, Washington, DC, February 1996.

Figure 4-7

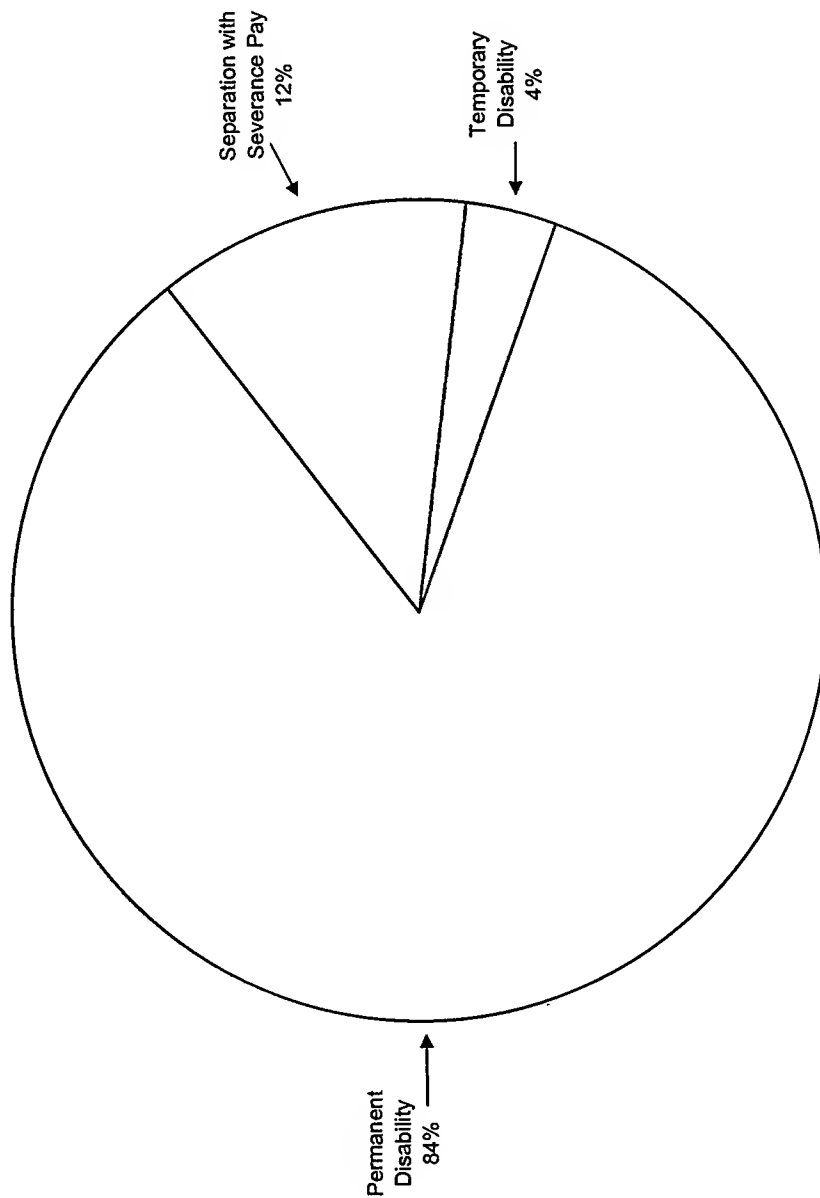
Costs of Disabilities.

Figure 4-8 illustrates the distribution of projected lifetime costs by disability dispositions (cases reviewed) for FY 1993:

- Permanent disability—84%.
- Separation with severance pay—12%.
- Temporary disability—4%.

The Army estimates the cost of its FY 1993 disability cases to be \$485 million.

Army - Distribution (%) of Projected Lifetime Costs by Disability Dispositions (Cases Reviewed), * FY 1993



Total value = \$485 million.
 * Based on FY 1993 \$ compensation per soldier.

Source: U.S. Army Physical Disability Agency, Walter Reed Army Medical Center, Forest Glen Annex, Washington, DC, February 1996.

Figure 4-8

4-7. Navy and Marine Corps

The Navy and Marine Corps disability data are presented in four parts:

- The Navy and Marine Corps Summary. The Navy and Marine Corps disability data presented in this section are summarized in two tables.
 - The overall summary is presented in Table 4-5.
 - The data in figures 4-9, 4-10, and 4-11 are summarized in Table 4-6.
- Magnitude of the Injury Problem Relative to Other Causes of Disability.
 - The distribution of Navy and Marine Corps disabilities evaluated by the PEB for the first 9 months of FY 1995 is displayed in figures 4-9, 4-10, and 4-11.
 - The distribution of disorders/injuries evaluated by the MEB for Navy personnel only for CY 1989-1993 is displayed in figures 4-12 and 4-13.
- Trends of Navy and Marine Corps Injury-Related Disabilities Relative to Other Causes Over Time. Rates of physical disability evaluations for FY 1985-1994 are displayed in Figure 4-14.
- Case Dispositions. The distribution of Navy and Marine Corps disability claim dispositions for FY 1994 is displayed in Figure 4-15.

The Navy and Marine Corps Summary.

Table 4-5. Overall Summary of Navy and Marine Corps Disability Data for Active Duty Personnel

Year	Total Navy and Marine Corps Population	Disabilities		Rates and Trends of Disabilities		Conclusion
		Total	n/1,000 Personnel/Year	n/1,000 Personnel/Year	Trend, % Change (FY 1985-1994)	
FY85-FY94	—	—	—	15/FY85 32/FY94	Up 113%	Overall disability rates increased more than twofold over a 10-year period.

Table 4-6. Summary of Navy and Marine Corps Disability Data by VASRD Codes

Disabilities*	Distribution (%) of Disabilities (FY 95 - first 9 months)		Conclusions
	Two-Digit Codes	Four-Digit Codes	
50-53: Musculoskeletal (Orthopedic) 5003, 5257, 5010: Degenerative Arthritis 5021: Myositis 5022: Periositis 5024: Tenosynovitis 5295: Lumbosacral Strain 5262: Tibia and Fibula, Impairment of 5276: Flatfoot, acquired 5293: Intervertebral Disc Syndrome 5299: Orthopedic	63% — — — — — — — —	— 31% 2% 1% 1% 8% 2% 1% 5% 53%	Musculoskeletal (Orthopedic) <ul style="list-style-type: none"> • Orthopedic injuries, the leading cause of disabilities, occur more than eight times as often as mental disorders. Mental Disorders <ul style="list-style-type: none"> • Mental disorders are the second leading cause of disabilities. Musculoskeletal <ul style="list-style-type: none"> • Degenerative arthritis, the leading cause of musculoskeletal disabilities, occur more than 3½ times as often as lumbosacral strain. • Lumbosacral strain is the second leading cause of musculoskeletal disabilities. Distribution of Disabilities <ul style="list-style-type: none"> • Musculoskeletal (orthopedic) injuries account for 63% of all disabilities.
60-62: Visual/Auditory	2%	—	
63-68: Systemic/Respiratory 6351/2: HIV-Related Illness 6602: Asthma, bronchial	6% — —	— 3% 5%	
70-71: Cardiovascular	4%	—	
72-73: Digestive 7323: Colitis, Ulcerative	2% —	— 1%	
75-76: Genitourinary/Gynecological	1%	—	
77-79: Blood/Skin/Endocrine 7913: Diabetes Mellitus	3% —	— 3%	
80-89: Neurological/Convulsive 8106: Chorea, Huntington's 8910: Epilepsy, grand mal	9% — —	— 4% 1%	
90-95: Mental Disorders 9209, 9411, 9405, 9206: Mental Disorders	10% —	— 6%	

* Codes as defined in 38 CFR 4.

Magnitude of the Injury Problem Relative to Other Causes of Disabilities.

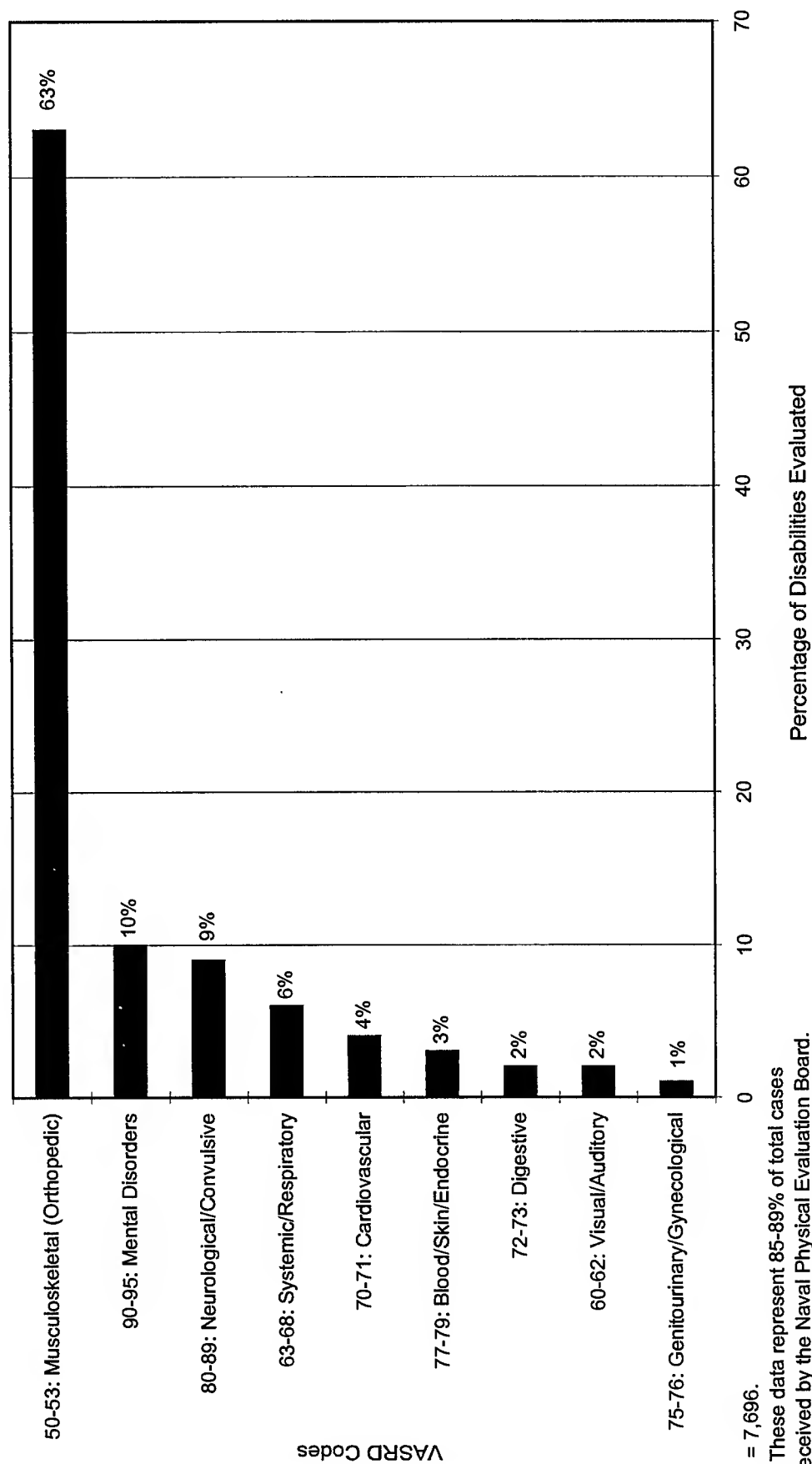
Figure 4-9 illustrates the distribution of disabilities by two-digit VASRD codes for Navy and Marine Corps personnel for the first 9 months of FY 1995 based on PEB findings. The top five codes were:

- Musculoskeletal (orthopedic)—63%.
- Mental disorders—10%.
- Neurological/convulsive—9%.
- Systemic/respiratory—6%.
- Cardiovascular—4%.

Disabilities due to musculoskeletal conditions are largely related to injuries and their sequelae. Musculoskeletal (orthopedic) conditions are the leading cause of disabilities and occur more than six times as often as mental disorders, the second leading cause of disabilities.

Some of the neurological conditions and mental disorders such as brain disease due to trauma (VASRD code 8045), paralysis (VASRD codes 8510-8530), and some brain disorders (VASRD code 9304) may be associated with brain trauma.

Navy and Marine Corps - Distribution (%) of Disabilities* by Two-Digit VASRD Codes,† FY 1995 (First 9 Months)



n = 7,696.

* These data represent 85-89% of total cases received by the Naval Physical Evaluation Board.

† VASRD codes as defined in 38 CFR 4.

Source: Naval Council of Personnel Boards, 1995.

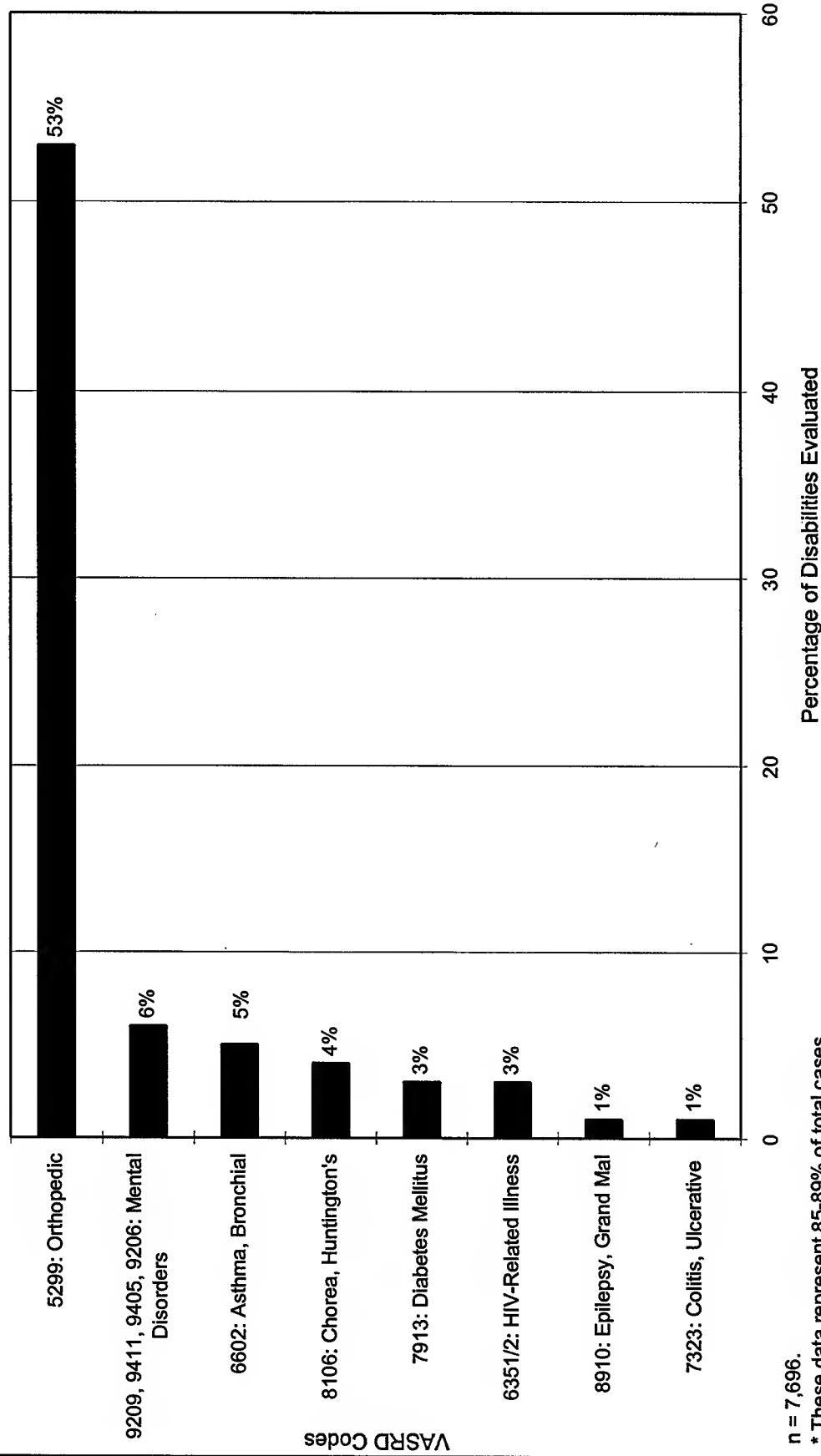
Figure 4-9

Figure 4-10 illustrates the distribution of disabilities by four-digit VASRD codes for Navy and Marine Corps personnel for the first 9 months of FY 1995 based on PEB findings. The top five codes were:

- Orthopedic—53%.
- Mental disorders—6%.
- Asthma, bronchial—5%.
- Chorea, Huntington's—4%.
- Diabetes mellitus/HIV-related illness—3% each.

Orthopedic conditions, the leading cause of disabilities, occur more than eight times as often as mental disorders, the second leading cause of disabilities.

Navy and Marine Corps - Distribution (%) of Disabilities* by Four-Digit VASRD Codes,† FY 1995 (First 9 Months)



n = 7,696.

* These data represent 85-89% of total cases received by the Naval Physical Evaluation Board.

† VASRD codes as defined in 38 CFR 4.

Source: Department of the Navy, Naval Council of Personnel Boards, Arlington, VA, 1995.

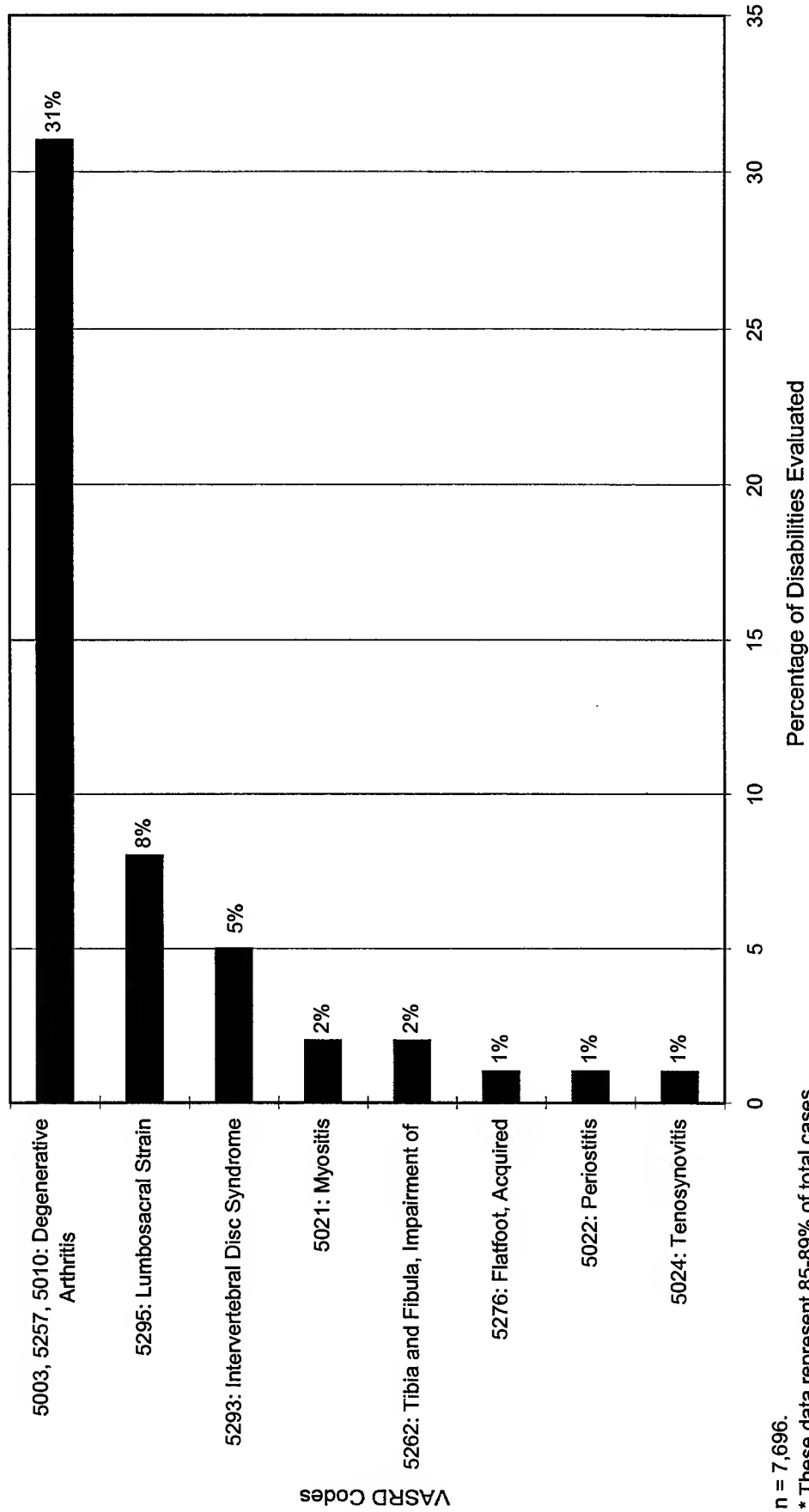
Figure 4-10

Figure 4-11 illustrates the distribution of the top musculoskeletal (orthopedic) disabilities by four-digit VASRD codes for Navy and Marine Corps personnel for the first 9 months of FY 1995. The top five musculoskeletal (orthopedic) codes were:

- Degenerative arthritis—31%.
- Lumbosacral strain—8%.
- Intervertebral disc syndrome—5%.
- Myositis—2%.
- Tibia and fibula, impairment of—2%.

Degenerative arthritis, the leading cause of musculoskeletal (orthopedic) disabilities, occurs more than three and a half times as often as lumbosacral strain, the second leading cause of musculoskeletal (orthopedic) disabilities.

Navy and Marine Corps - Distribution (%) of Top Musculoskeletal (Orthopedic) Disabilities by Four-Digit VASRD Codes,*† FY 1995 (First 9 Months)



n = 7,696.

* These data represent 85-89% of total cases received by the Naval Physical Evaluation Board.

† VASRD codes as defined in 38 CFR 4.

Source: Department of the Navy, Naval Council of Personnel Boards, Arlington, VA, 1995.

Figure 4-11

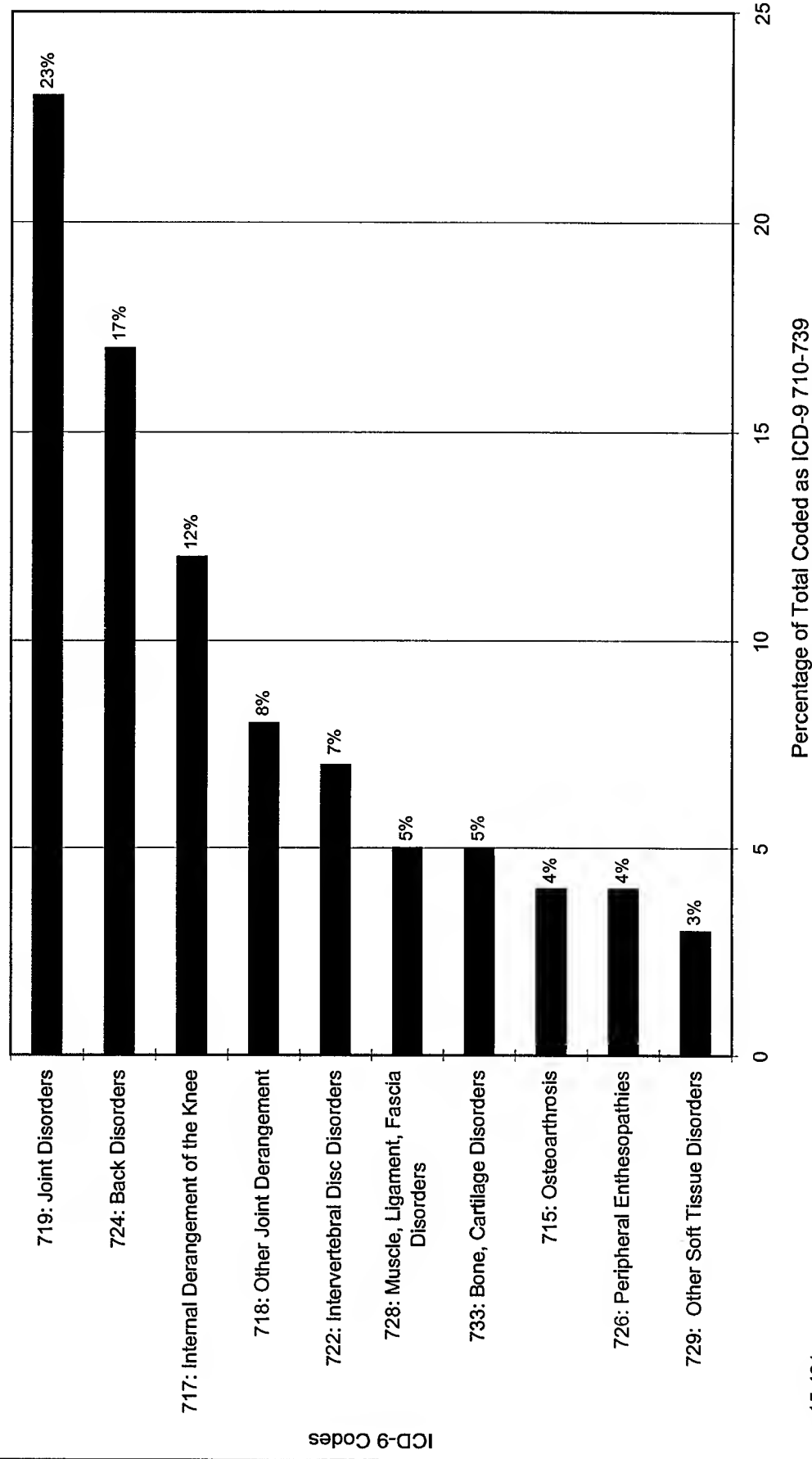
**Navy Medical Evaluation Board Data for
Musculoskeletal (Orthopedic) and Connective Tissue Disorders, CY 1989-1993**

Figure 4-12 illustrates the distribution of top 10 diagnoses of musculoskeletal (orthopedic) and connective tissue disorders (ICD-9 codes 710-739) for Navy personnel for CY 1989-1993 based on MEB findings. The total number of cases evaluated by the Navy MEBs was 15,491, with the following top five contributors to musculoskeletal (orthopedic) and connective tissue disorders:

- Joint disorders—23 %.
- Back disorders—17 %.
- Internal derangement of the knee—12 %.
- Other joint derangement—8 %.
- Intervertebral disc disorders—7 %.

These top five contributors to musculoskeletal (orthopedic) and connective tissue disorders accounted for 67% (10,317) of all MEB cases.

Navy - Distribution (%) of Top 10 Diagnoses of Musculoskeletal (Orthopedic) and Connective Tissue Disorders (ICD-9 Codes 710-739) Evaluated by Medical Evaluation Boards, CY 1989-1993



n = 15,491.
Other = 12%.

Source: U.S. Naval Medical Information Management System, 1994.

Figure 4-12

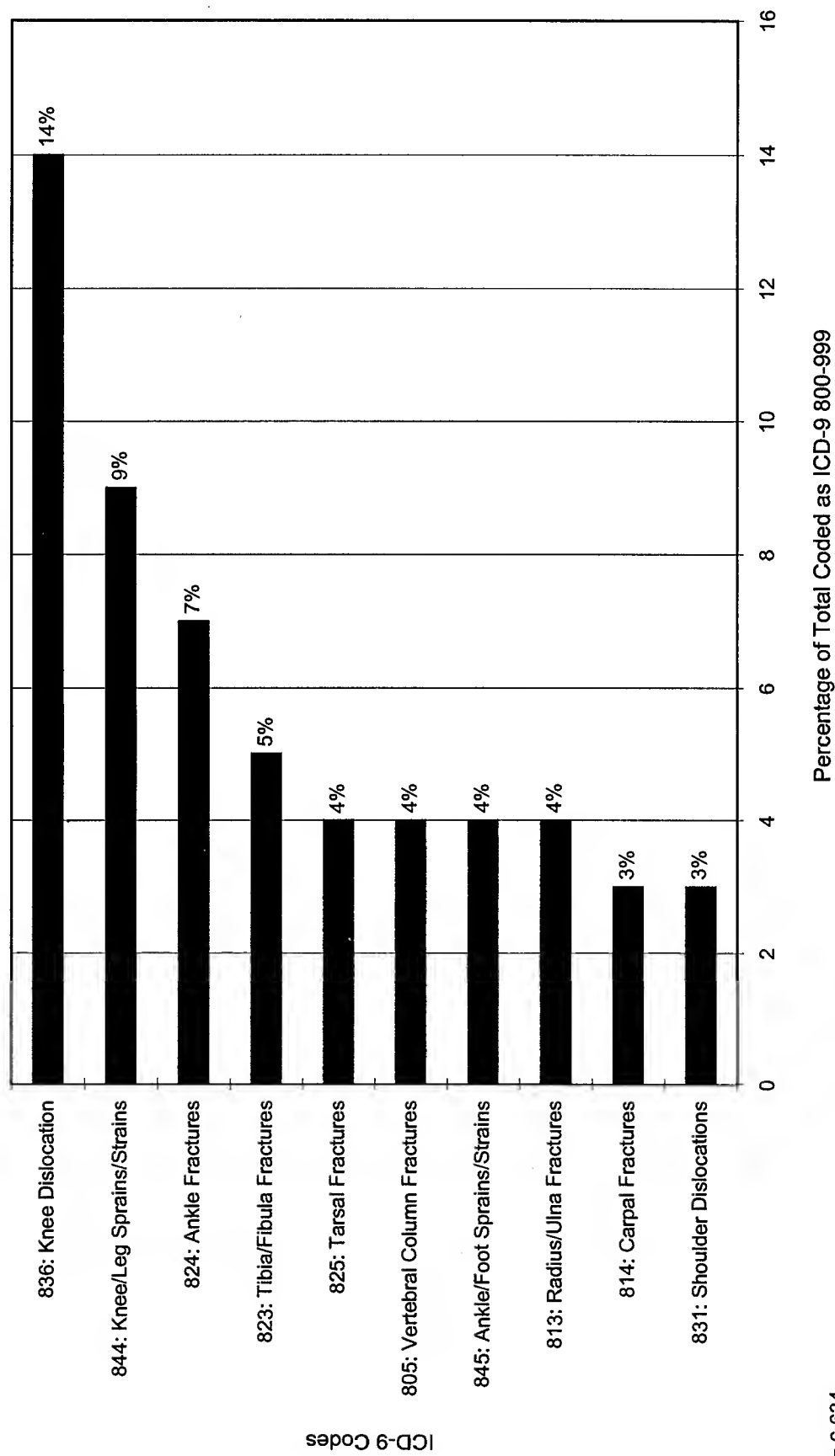
Navy Medical Evaluation Board Data for Injuries and Accidents, CY 1989-1993

Figure 4-13 illustrates the distribution of the top 10 diagnoses of injuries and accidents (ICD-9 codes 800-999) for Navy personnel for CY 1989-1993 based on MEB findings. The total number of cases evaluated by the Navy MEB was 6,634, with the following top five injury and accident diagnoses:

- Knee dislocation—14%.
- Knee/leg sprains/strains—9%.
- Ankle fractures—7%.
- Tibia/fibula fractures—5%.
- Tarsal fractures—4%.

These top five contributors to injuries and accidents accounted for 39% (2,587) of all MEB cases.

Navy - Distribution (%) of Top 10 Diagnoses of Injuries and Accidents (ICD-9 Codes 800-999) Evaluated by Medical Evaluation Boards, CY 1989-1993



n = 6,634.
Other = 44% (2,919).

Source: U.S. Naval Medical Information Management System, 1994.

Figure 4-13

Trends of Navy and Marine Corps Injury-Related Disabilities Relative to Other Causes Over Time.

Figure 4-14 illustrates the overall rates of active duty and Reserve disability cases for the Navy and Marine Corps for FY 1985-1994. These rates do not represent the cases that are subsequently evaluated and receive a disposition. In general, the rate of cases evaluated is lower than the rate of cases entering the system. Active duty personnel as well as members of the Naval Reserves are included in the rates seen here.

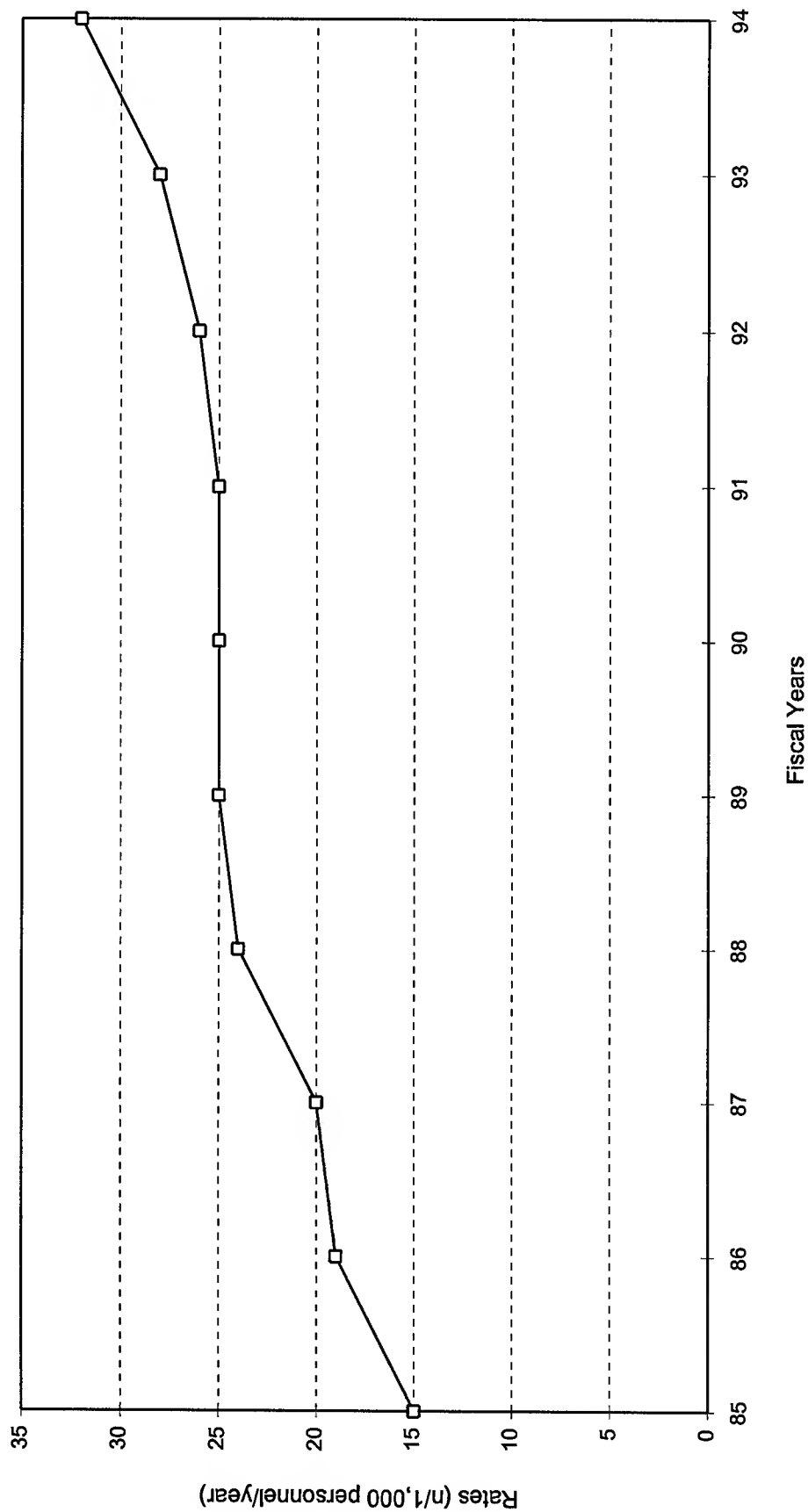
Disabilities increased 113% from 15 cases per 1,000 active duty personnel in FY 1985 to 32 cases per 1,000 active duty personnel in FY 1994.

Worksheet Data for Figure 4-14

Navy and Marine Corps - Rates of Total Disability Cases Received by Fiscal Year*									
1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
15	19	20	24	25	25	25	26	28	32

* Rates per 1,000 personnel calculated using denominator data in Table 1-7.

Navy and Marine Corps - Overall Rates of Active Duty and Reserve Disability Cases, FY 1985-1994



Numerator Source: Department of the Navy, Naval Council of Personnel Boards, Arlington, VA, 1995.
Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

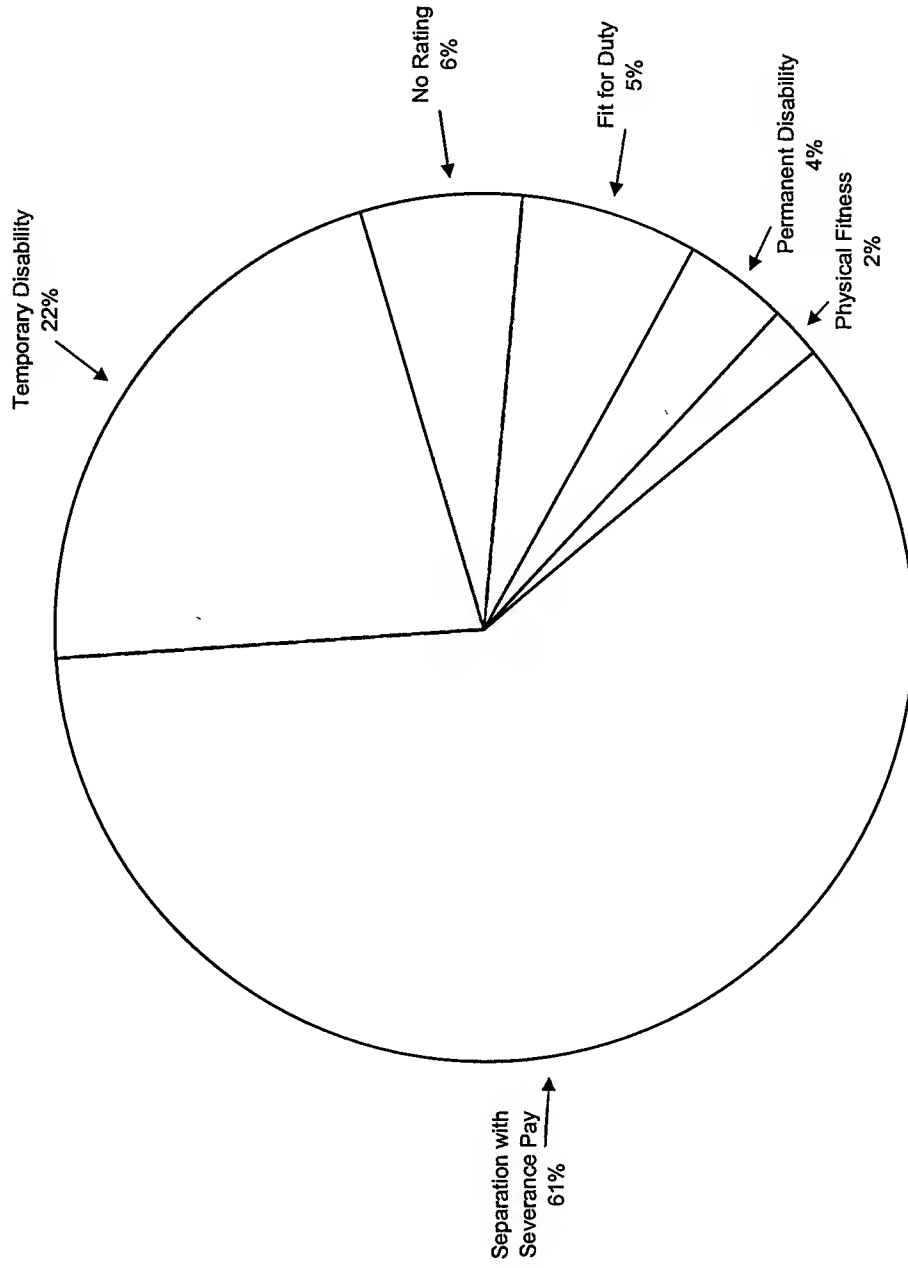
Figure 4-14

Case Dispositions.

Figure 4-15 illustrates the distribution of 10,786 disability dispositions (cases reviewed) for Navy and Marine Corps active duty and reserve personnel for FY 1994:

- Separation with severance pay—61%.
- Temporary disability—22%.
- No rating—6%.
- Fit for duty—5%.
- Permanent disability—4%.
- Physical fitness—2%.

Navy and Marine Corps - Distribution (%) of Active Duty/Reserve Disability Dispositions (Cases Reviewed), FY 1994



n = 10,786.

Source: Department of the Navy, Naval Council of Personnel Boards, Arlington, VA, 1995.

Figure 4-15

4-8. Air Force

The Air Force disability data are presented in four parts:

- The Air Force Summary. The Air Force disability data presented in this section are summarized in two tables.
- The overall summary is presented in Table 4-7.
- The data in figures 4-16, 4-17, 4-18, and 4-19 are summarized in Table 4-8.
- Magnitude of the Injury Problem Relative to Other Causes of Disability.
- The distribution of disabilities by two-digit VASRD codes is displayed in Figure 4-16 for FY 1993 and in Figure 4-17 for FY 1994.
- The distribution of disabilities by top 15 four-digit VASRD codes is displayed in Figure 4-18 for FY 1993 and Figure 4-19 for FY 1994.
- Trends of Air Force Injury-Related Disabilities Relative to Other Causes Over Time. The rates of total disability cases for FY 1990-September 1995 are displayed in Figure 4-20.
- Case Dispositions. The distribution of Air Force PEB disability claim dispositions is displayed in Figure 4-21 for FY 1993 and in Figure 4-22 for FY 1994.

The Air Force Summary.

Table 4-7. Overall Summary of Air Force Disability Data for Active Duty Personnel

Table 4-7. Overall Summary of Air Force Disability Data for Active Duty Personnel							
Year	Total Air Force Population	Disabilities		Rates and Trends of Disabilities			Conclusion
		Total	n/1,000 Personnel/Year	n/1,000 Personnel/Year	Trend, % Change (FY 1990-1994)		
FY90-FY94	—	—	—	5/FY90	9/FY94	Up 80%	Disabilities increased nearly twofold from FY 1990 to FY 1994.
FY93	444,351	2,940	7	—	—	—	
FY94	426,327	3,687	9	—	—	—	

Table 4-8. Summary of Air Force Disability Data by VASRD Codes*

Disabilities	Distribution (%) of Disabilities				Conclusions
	Two-Digit Codes		Four-Digit Codes		
	FY93	FY94	FY93	FY94	
50-53: Musculoskeletal (Orthopedic)					Distribution of Disabilities <ul style="list-style-type: none">• Musculoskeletal conditions accounted for 29% of all disabilities in FY 1993 and 22% of all disabilities in FY 1994.• Asthma, the leading disability code, increased almost 129% from FY 1993 to FY 1994.• Diabetes mellitus, the second leading disability code, increased 1% from FY 1993 to FY 1994. Musculoskeletal (Orthopedic) <ul style="list-style-type: none">• Although musculoskeletal (orthopedic) rates declined in FY 1994, they continued to be the leading cause of disabilities. Mental Disorders <ul style="list-style-type: none">• Although mental disorders increased in FY 1994, they continued to be the second leading cause of disabilities.
5295: Lumbosacral Strain	29%	22%	—	—	
5257: Knee, Other Impairment of	—	—	4%	4%	
5262: Tibia and Fibula, Impairment of	—	—	6%	4%	
5293: Intervertebral Disc Syndrome	—	—	3%	2%	
5299: Orthopedic	—	—	5%	4%	
	—	—	2%	0%	
60-62: Visual/Auditory					
6062: Visual/Auditory	2%	2%	—	—	
63-68: Systemic/Respiratory					
6350: Lupus Erythematosus, Systemic	14%	14%	—	—	
6351/2: HIV-Related Illness	—	—	2%	0%	
6602: Asthma, Bronchial	—	—	3%	2%	
	—	—	7%	16%	
70-71: Cardiovascular					
7005: Arteriosclerotic Heart Disease	8%	6%	—	—	
	—	—	3%	3%	
72-73: Digestive					
7323: Colitis, Ulcerative	6%	5%	—	—	
	—	—	3%	3%	
75-76: Genitourinary/Gynecological					
7528: New growths, malignant, any specified part of genitourinary system	3%	4%	—	—	
	—	—	0%	2%	
77-79: Blood/Skin/Endocrine					
7913: Diabetes Mellitus	11%	12%	—	—	
	—	—	6%	7%	
80-89: Neurological/Convulsive					
8106: Chorea, Huntington's	11%	13%	—	—	
8910: Epilepsy, Grand Mal	—	—	2%	2%	
8914: Epilepsy, Psychomotor	—	—	2%	4%	
	—	—	0%	2%	
90-95: Mental Disorders					
9206: Manic Depressive Reaction	15%	21%	—	—	
9405: Depressive Reaction	—	—	2%	1%	
	—	—	4%	5%	

* Codes as defined in 38 CFR 4.

Magnitude of the Injury Problem Relative to Other Causes of Disabilities.

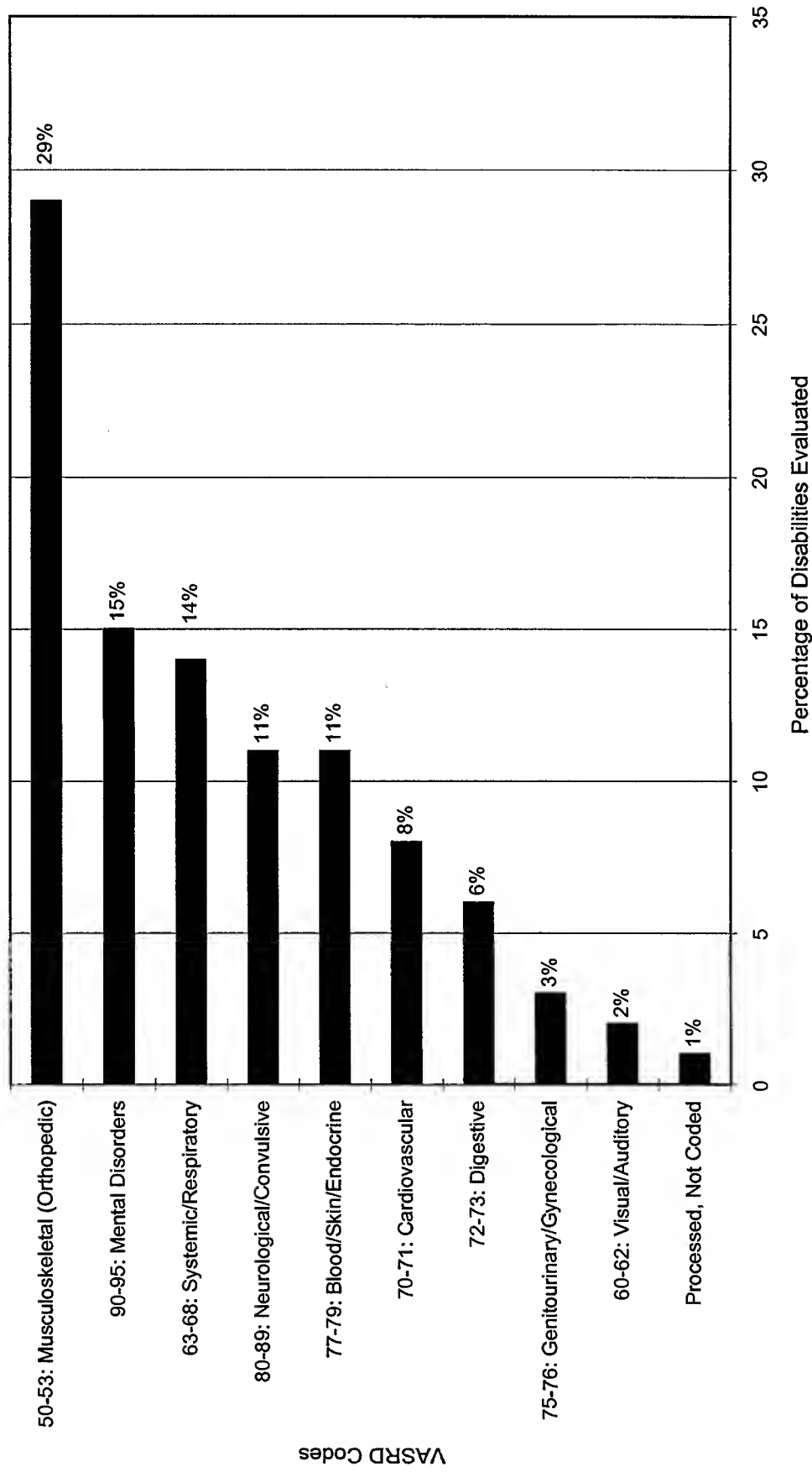
Figure 4-16 illustrates the distribution of 2,940 disabilities by two-digit VASRD codes for active duty Air Force personnel for FY 1993. The top five codes were:

- Musculoskeletal (orthopedic)—29%.
- Mental disorders—15%.
- Systemic/respiratory—14%.
- Neurological/convulsive—11%
- Blood/skin/endocrine—11%

Musculoskeletal (orthopedic) conditions are the leading cause of disabilities and occur almost twice as often as mental disorders, the second leading cause of disabilities.

Disabilities due to musculoskeletal conditions are largely related to injuries and their sequelae. In addition, some of the neurological conditions and mental disorders such as brain disease due to trauma (VASRD code 8045), paralysis (VASRD codes 8510-8530), and some brain disorders (VASRD code 9304) may be associated with brain trauma.

Air Force - Distribution (%) of Disabilities by Two-Digit VASRD Codes,* FY 1993



n = 2,940 (active duty only).

* VASRD codes as defined in 38 CFR 4.

Source: Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.

Figure 4-16

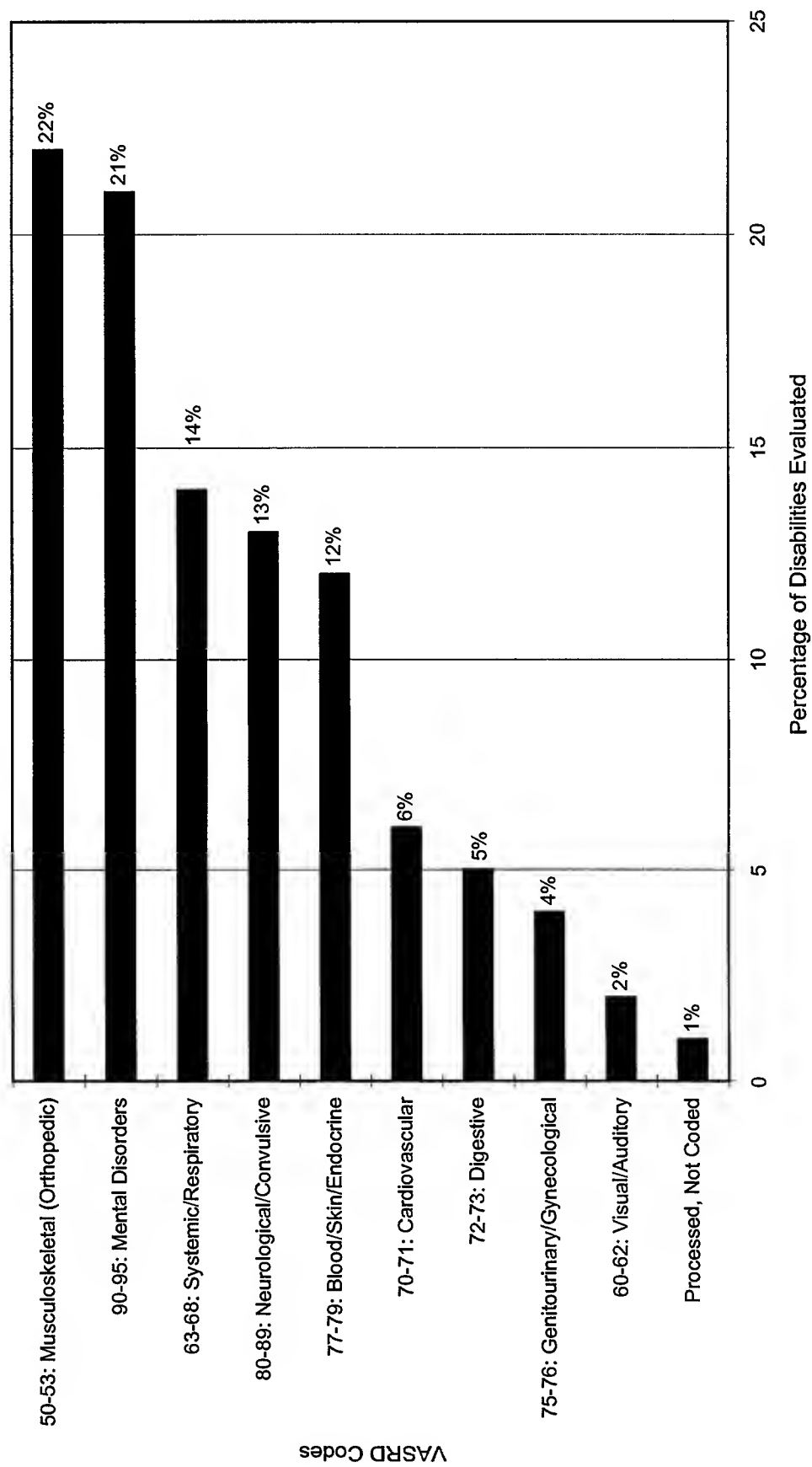
Figure 4-17 illustrates the distribution of 3,687 disabilities by two-digit VASRD codes for active duty Air Force personnel for FY 1994. The top five codes were:

- Musculoskeletal (orthopedic)—22%.
- Mental disorders—21%.
- Systemic/respiratory—14%.
- Neurological/convulsive—13%.
- Blood/skin/endocrine—12%.

Musculoskeletal (orthopedic) conditions, the leading cause of disabilities, and mental disorders, the second leading cause of disabilities, occur at nearly the same frequency.

Disabilities due to musculoskeletal conditions are largely related to injuries and their sequelae. In addition, some of the neurological conditions and mental disorders such as brain disease due to trauma (VASRD code 8045), paralysis (VASRD codes 8510-8530), and some brain disorders (VASRD code 9304) may be associated with brain trauma.

Air Force - Distribution (%) of Disabilities by Two-Digit VASRD Codes,* FY 1994



n = 3,687 (active duty only).

* VASRD codes as defined in 38 CFR 4.

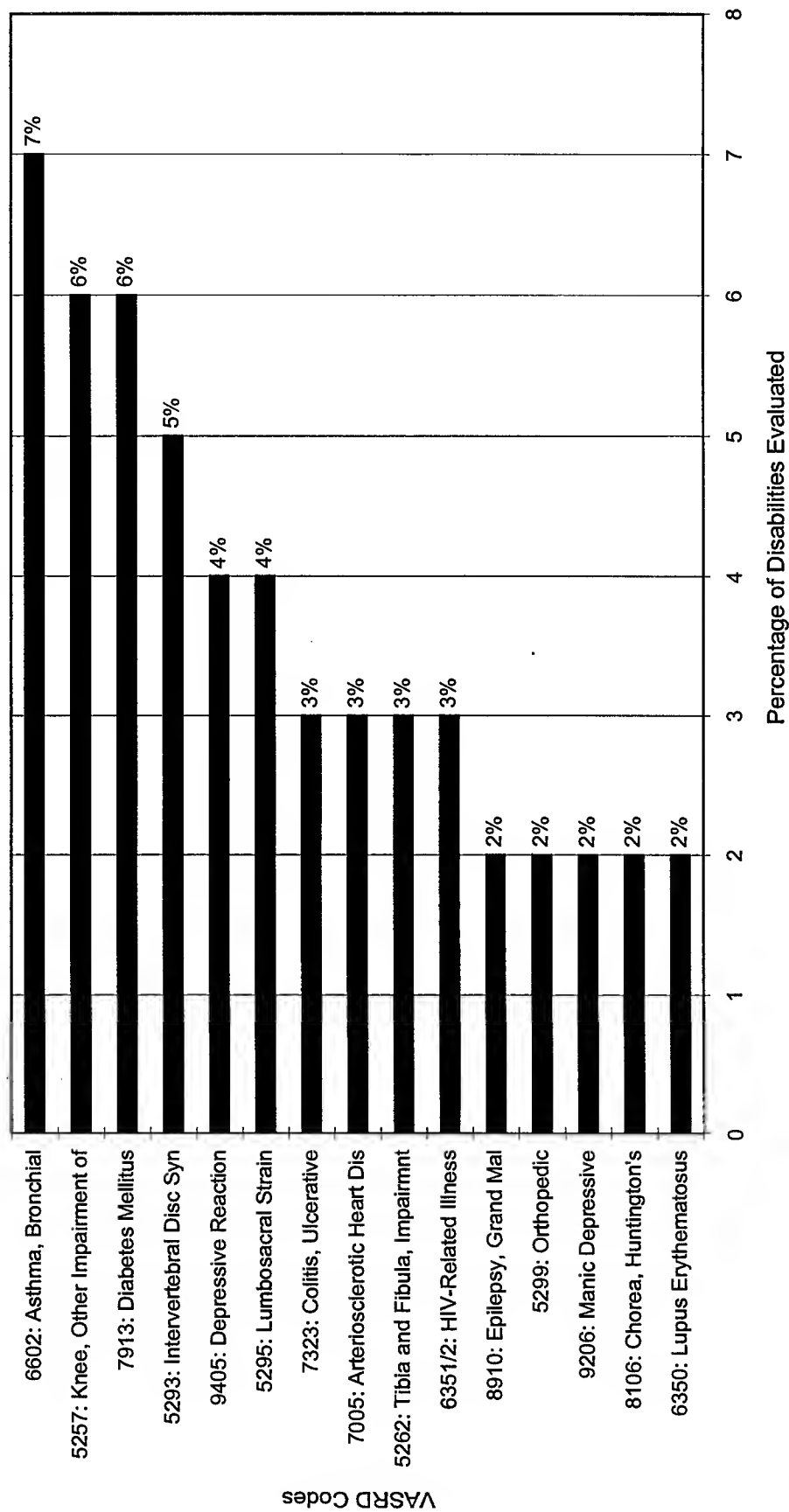
Source: Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.

Figure 4-17

Figure 4-18 illustrates the distribution of the top 15 disabilities by four-digit VASRD codes for active duty Air Force personnel for FY 1993. Five of the top 15 disability codes are musculoskeletal (orthopedic) conditions:

- Knee, other impairment of—6%.
- Intervertebral disc syndrome—5%.
- Lumbosacral strain—4%.
- Tibia and fibula, impairment of—3%.
- Orthopedic—2%.

Air Force - Distribution (%) of Top 15 Disabilities by Four-Digit VASRD Codes,* FY 1993



n = 2,940 (active duty only).

* VASRD codes as defined in 38 CFR 4.

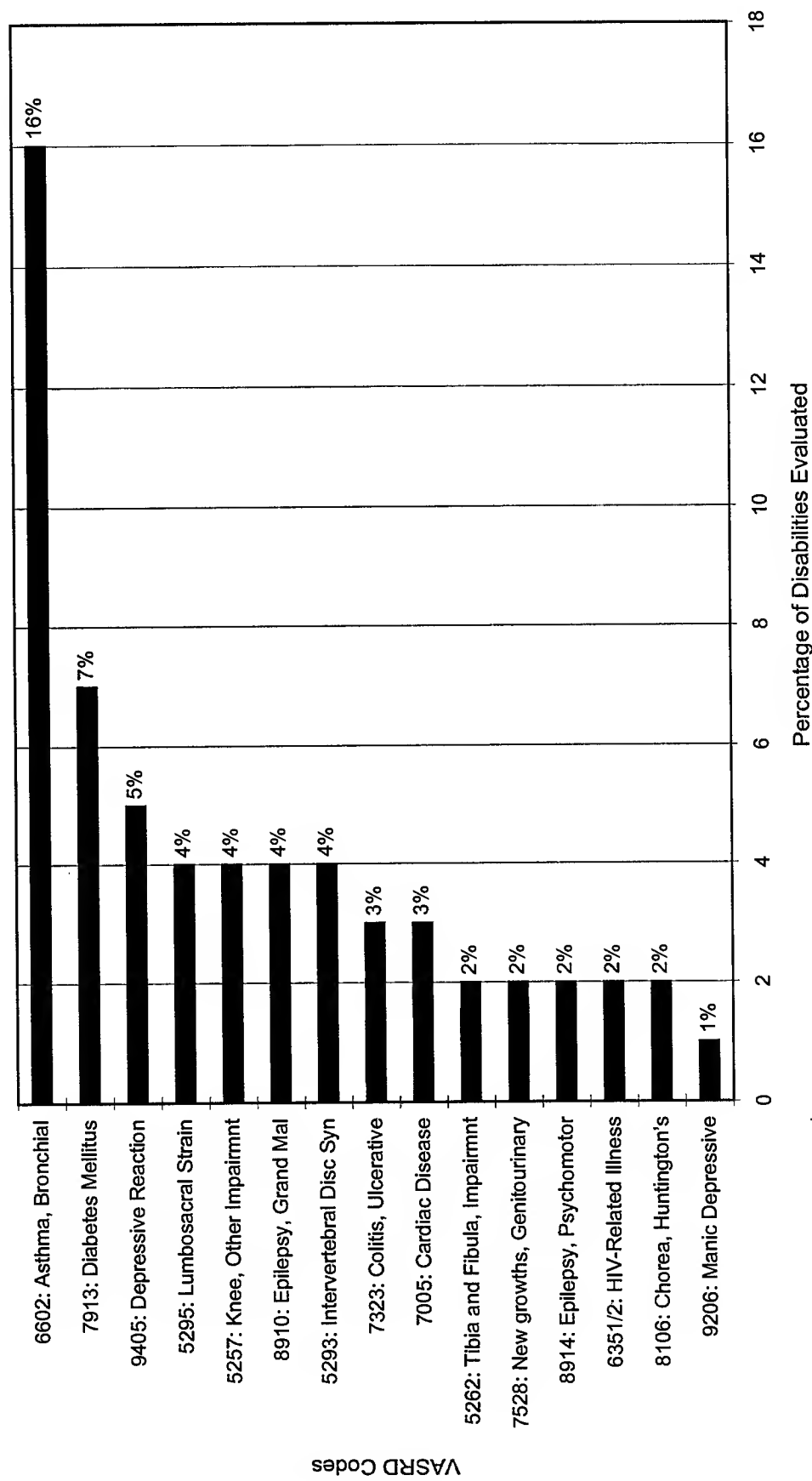
Source: Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.

Figure 4-18

Figure 4-19 illustrates the distribution of the top 15 disabilities by four-digit VASRD codes for active duty Air Force personnel for FY 1994. Four of the top 15 disability codes are musculoskeletal (orthopedic) conditions:

- Lumbosacral strain—4%.
- Knee, other impairment of—4%.
- Intervertebral disc syndrome—4%.
- Tibia and fibula, impairment of—2%.

Air Force - Distribution (%) of Top 15 Disabilities by Four-Digit VASRD Codes,* FY 1994



n = 3,687 (active duty only).

* VASRD codes as defined in 38 CFR 4.

Source: Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.

Figure 4-19

Trends of Air Force Injury-Related Disabilities Relative to Other Causes Over Time.

Figure 4-20 illustrates the rates of Air Force disability cases evaluated for FY 1990-September 1995. These rates represent the active duty disability cases that were evaluated by the PEB and received a disposition, as well as the reevaluations of disability cases on the TDRL.

- Active duty and TDRL cases evaluated:
 - Increased 86% from 7 cases per 1,000 active duty personnel in FY 1990 to 13 cases per 1,000 active duty personnel in FY 1994.
 - Decreased 23% from 13 cases per 1,000 active duty personnel in FY 1994 to 10 cases per 1,000 active duty personnel through September 1995.
- Active duty cases evaluated:
 - Increased 80% from 5 cases per 1,000 active duty personnel in FY 1990 to 9 cases per 1,000 active duty personnel in FY 1994.
 - Decreased 9% from 9 cases per 1,000 active duty personnel in FY 1994 to 8 cases per 1,000 active duty personnel through September 1995.

Worksheet Data for Figure 4-20

Disability Cases Evaluated	Air Force - Rates of Total Disability Cases by Fiscal Year*				
	1990	1991	1992	1993	Sep 1995
Active Duty and TDRL	7	8	10	10	10
Active Duty	5	5	6	7	8

* Rates per 1,000 personnel calculated using denominator data in Table 1-7.

Air Force - Rates of Disability Cases, FY 1990-September 1995

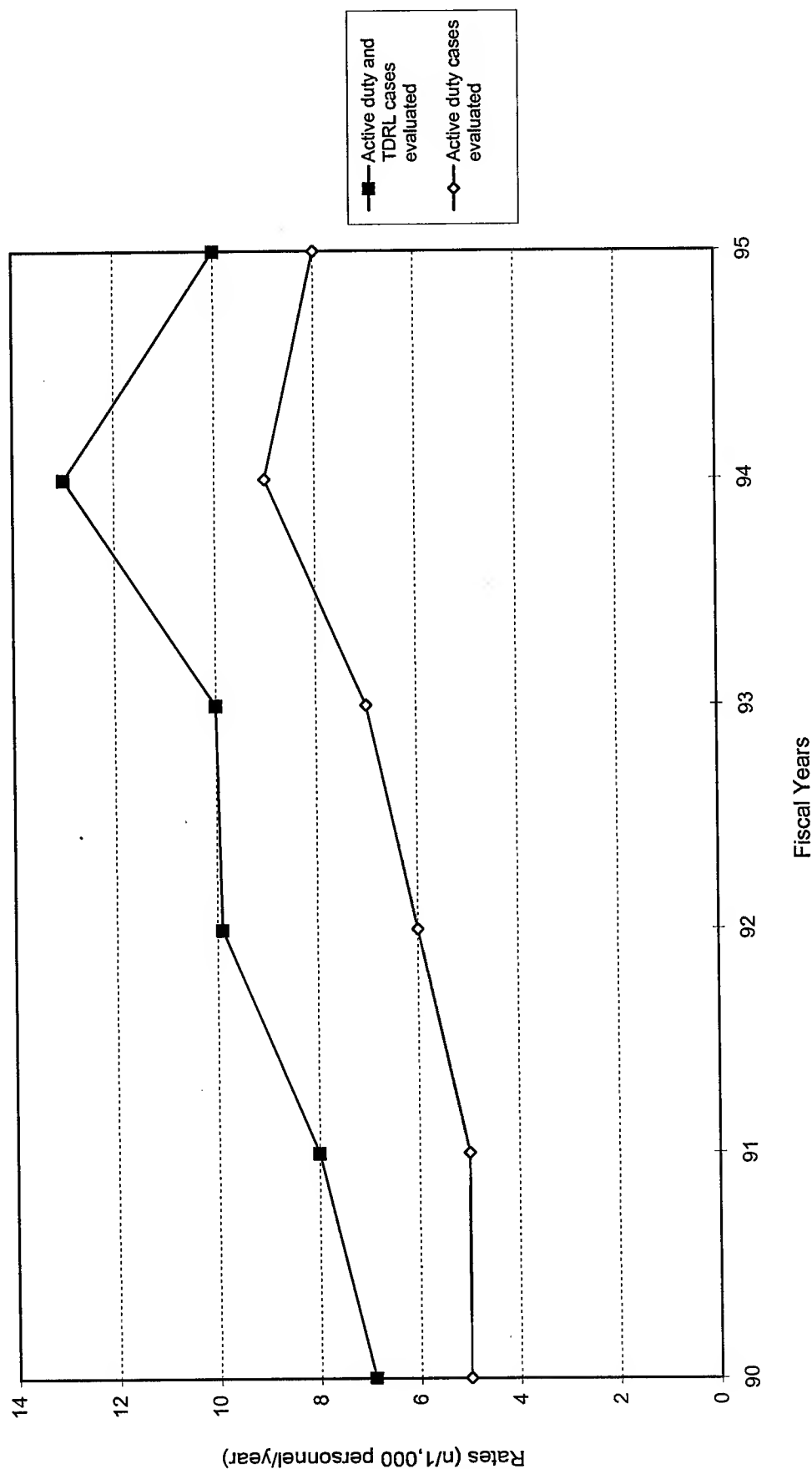


Figure 4-20

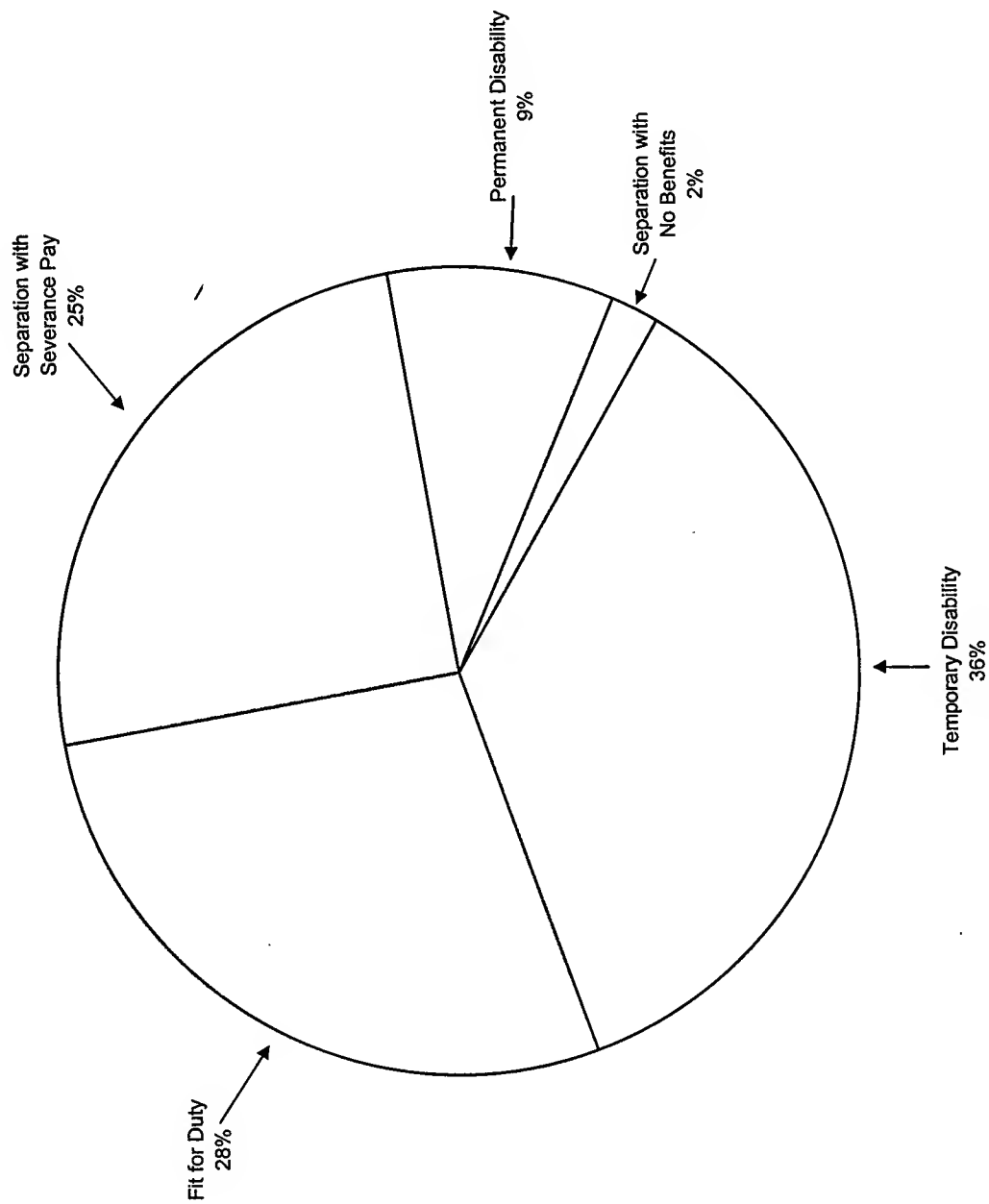
Sources: Numerator: Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.
 Denominator: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Case Dispositions.

Figure 4-21 illustrates the distribution of 2,940 PEB disability claim dispositions for active duty Air Force personnel for FY 1993:

- Temporary disability—36%.
- Fit for duty—28%.
- Separation with severance pay—25%.
- Permanent disability—9%.
- Separation with no benefits—2%.

Air Force - Distribution (%) of Disability Claim Dispositions, FY 1993



n = 2,940 (active duty only).

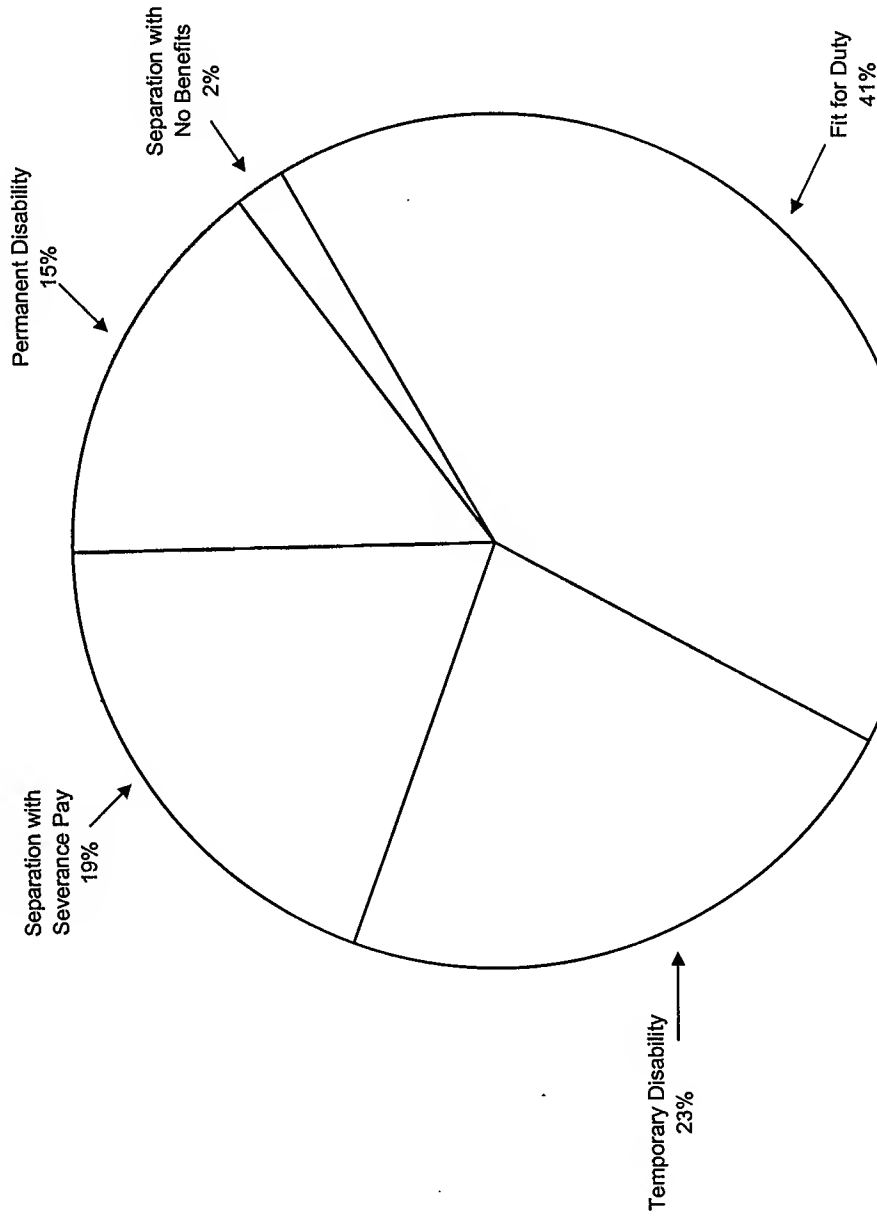
Source: Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.

Figure 4-21

Figure 4-22 illustrates the distribution of 3,687 PEB disability claim dispositions for active duty Air Force personnel for FY 1994:

- Fit for duty—41%.
- Temporary disability—23%.
- Separation with severance pay—19%.
- Permanent disability—15%.
- Separation with no benefits—2%.

Air Force - Distribution (%) of Disability Claim Dispositions, FY 1994



n = 3,687 (active duty only).

Source: Department of the Air Force, HQ Air Force Personnel Center, Randolph AFB, TX, 1995.

Figure 4-22

4-9. Comparison of All Services

The military disability data for each service, presented in paragraphs 4-6 through 4-8, are compared and presented in three tables:

- Each service's distribution of disabilities by VASRD codes is compared in Table 4-9.
- Each service's FY 1994 distribution of dispositions (cases reviewed) is compared in Table 4-10.

Table 4-9. Distribution of Disabilities by Two-Digit VASRD Codes for Active Duty Personnel—A Comparison of All Services

Disabilities*	Distribution (%) of Disabilities			Conclusions
	Army FY 1994	Navy and Marine Corps FY 1995 (first 9 months)	Air Force FY 1994	
50-53: Musculoskeletal (Orthopedic)	53%	63%	22%	Musculoskeletal (Orthopedic) <ul style="list-style-type: none"> • Musculoskeletal (orthopedic) conditions are the leading cause of disability for all three services. • Musculoskeletal (orthopedic) conditions were a less important cause of disability in the Air Force. Mental Disorders <ul style="list-style-type: none"> • Mental disorders were the second leading cause of disability for all services.
90-95: Mental Disorders	14%	10%	21%	
80-89: Neurological/Convulsive	12%	9%	13%	
63-68: Systemic/Respiratory	7%	6%	14%	
70-71: Cardiovascular	3%	4%	6%	
77-79: Blood/Skin/Endocrine	3%	3%	12%	
72-73: Digestive	3%	2%	5%	
60-62: Visual/Auditory	2%	2%	2%	
75-76: Genitourinary/Gynecological	1%	1%	4%	

* Codes as defined in 38 CFR 4.

Table 4-10. Distribution of Dispositions (Cases Reviewed) for Active Duty Personnel for FY 1994—A Comparison of All Services

Disability Dispositions	Distribution (%) of Dispositions			Conclusions
	Army	Navy and Marine Corps	Air Force	
Separation with Severance Pay	43%	61%	19%	<p>Separation with Severance Pay</p> <ul style="list-style-type: none"> The greatest percentage of cases evaluated by the Army, Navy, and Marine Corps received severance pay. Cases receiving separation with severance pay represent a one-time cost to the services. <p>Fit for Duty</p> <ul style="list-style-type: none"> For the Air Force, the majority of disability cases evaluated were deemed fit for duty. <p>Temporary Disability</p> <ul style="list-style-type: none"> Temporary disabilities accounted for 17% to 23% of all disability cases evaluated in the services. Upon reevaluation, these cases are reclassified as either fit for duty or permanent in nature. <p>Permanent Disability</p> <ul style="list-style-type: none"> Permanent disabilities accounted for 4% to 15% of disability cases evaluated. The Navy and Marine Corps had the lowest percentage of permanent disabilities. The number of permanent disability cases accumulates over time and represents a continuous cost to the services.
Temporary Disability	17%	22%	23%	
Permanent Disability	15%	4%	15%	
Separation with No Benefits	4%	—	2%	
No Rating	—	6%	—	
Physical Fitness	—	2%	—	
Fit for Duty	21%	5%	41%	

4-10. Department of Defense

In 1990, 143,441 former service members received disability compensation payments. The average compensation for officers was \$19,186, while the average compensation for enlisted service members was \$7,133. Officers represented only 30% of the disabled population yet accounted for 54% of the total payments in 1990.

Figure 4-23 illustrates the trends of combined disability compensation costs paid by the military departments (Army, Navy and Marine Corps, and Air Force) for FY 1980-1990. Individuals with permanent disabilities are compensated for life. Individuals with temporary disabilities are compensated for a maximum of 5 years, though most ultimately receive permanent disability retirements. Severance pay is a one-time lump-sum payment. Costs displayed reflect only direct payments to individuals and are based on percent disability, base pay, and length of service.

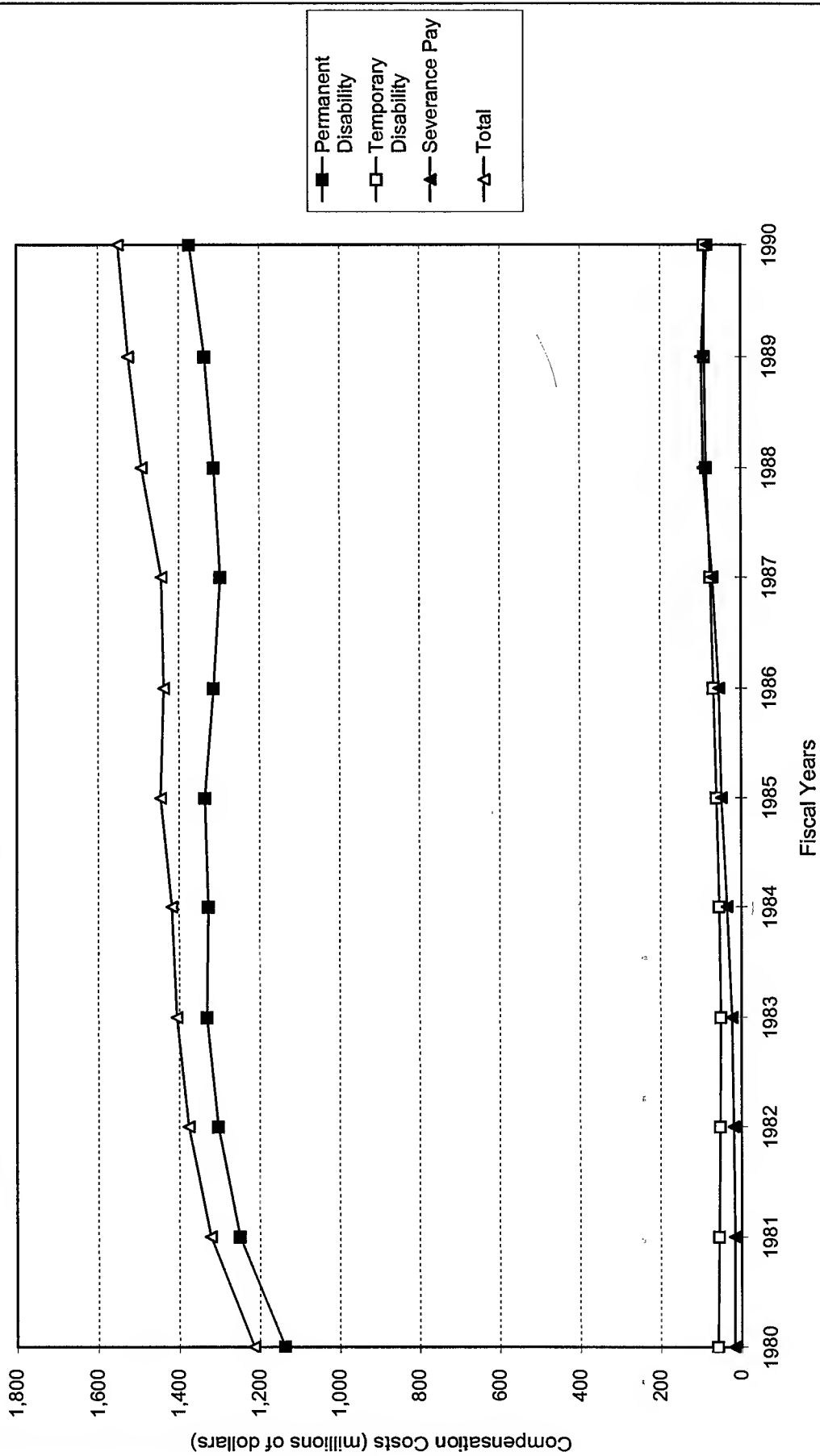
Disability compensation costs paid directly by the services represent only about 10% of all such payments. Most disabled service members are, in fact, compensated by the VA and are not included in the data presented in Figure 4-23. In addition to the direct annual payments to individuals displayed here, the DoD Actuary estimates that the annual obligation for *future* disability payments is close to 1.5 billion dollars per year for *new* disability cases each year. A set aside of 1% of the total basic pay of all active duty service members is needed to cover this cost (personal communication, Office of the DoD Actuary, 20 August 1998).

Worksheet Data for Figure 4-23

Compensation Costs	DoD - Rates of Combined Disability Compensation Costs by Fiscal Year*										
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Permanent Disability	\$1,137.0	\$1,249.0	\$1,303.0	\$1,331.0	\$1,327.0	\$1,335.0	\$1,313.0	\$1,296.0	\$1,312.0	\$1,335.0	\$1,373.0
Temporary Disability	\$59.1	\$55.7	\$53.3	\$51.4	\$54.8	\$61.1	\$68.6	\$75.9	\$86.0	\$90.9	\$91.6
Severance Pay	\$17.9	\$16.4	\$20.0	\$23.4	\$36.0	\$49.4	\$55.1	\$70.7	\$93.2	\$98.6	\$85.2
Total	\$1,214.0	\$1,321.1	\$1,376.3	\$1,405.8	\$1,417.8	\$1,445.5	\$1,436.7	\$1,442.6	\$1,491.2	\$1,524.5	\$1,549.8

* Rates per 1,000 personnel calculated using denominator data in Table 1-7.

DoD - Trends of Combined Disability Compensation Costs Paid by the Military Departments (Army, Navy and Marine Corps, and Air Force), FY 1980-1990



Source: Military Compensation Background Paper, OUSD/P&R(MPP), November 1991.

Figure 4-23

4-11. Veterans Administration

The VA disability data for December 1994 are presented in three parts:

- The VA Summary. The VA disability case and compensation data are summarized in tables 4-11 and 4-12.
- Magnitude of the Injury Problem Relative to Other Causes of Disability. The distribution of total disability cases by two-digit VASRD codes is displayed in Figure 4-24.
- Costs of Disabilities.
 - The distribution of disability compensation costs by two-digit VASRD codes is displayed in Figure 4-25.
 - The cost per case by two-digit VASRD codes is displayed in Figure 4-26.

Table 4-11. Overall Summary of VA Disability Case and Compensation Data, December 1994

Total Disability Cases	Disability Compensation Costs		Conclusions
	Total Cost Per Month	Average Cost Per Case Per Month	
2,221,547	\$1.02 billion	\$443	<ul style="list-style-type: none"> • The total cost to the military services for VA disability cases is about one billion dollars per month (see Figure 4-25). • These costs are in addition to the individual service-related costs. For example, the projected lifetime costs to the Army were \$485 million for disability cases that occurred in FY 1993 (see Figure 4-8).

Table 4-12. Summary of VA Disability Case and Compensation Data by VASRD Codes, December 1994

Disabilities by VASRD Codes*	Total Disability Compensation Costs/Month			Conclusions
	(%)	Million Dollars	Average Cost Per Case	
50-53: Musculoskeletal (Orthopedic)	34%	\$346.8	\$322	Musculoskeletal (Orthopedic) <ul style="list-style-type: none"> • Musculoskeletal (orthopedic) conditions accounted for a third of disability costs in December 1994. Mental Disorders <ul style="list-style-type: none"> • Mental disorders accounted for a quarter of disability costs in December 1994. • Mental disorders and neurological/convulsive conditions accounted for the highest costs per case.
90-95: Mental Disorders	26%	\$265.2	\$794	
80-89: Neurological/Convulsive	10%	\$102.0	\$741	
70-71: Cardiovascular	8%	\$81.6	\$424	
60-62: Visual/Auditory	6%	\$61.2	\$353	
63-68: Systemic/Respiratory	5%	\$51.0	\$352	
77-79: Blood/Skin/Endocrine	5%	\$51.0	\$259	
72-73: Digestive	4%	\$40.8	\$305	
75-76: Genitourinary/Gynecological	2%	\$20.4	\$431	

* Codes as defined in 38 CFR 4.

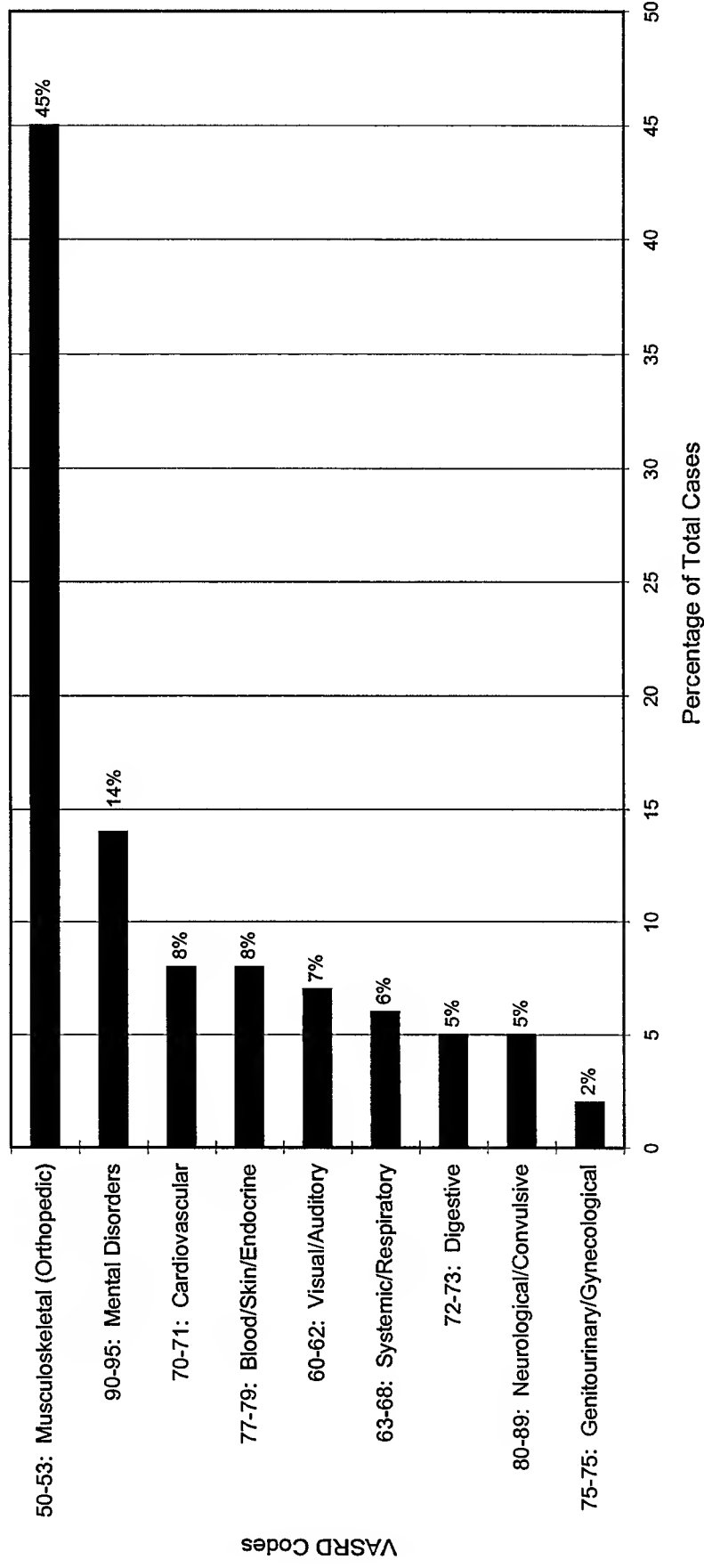
Magnitude of the Injury Problem Relative to Other Causes of Disabilities.

Figure 4-24 illustrates the distribution of total disability cases by two-digit VASRD codes for December 1994. The top five codes were:

- Musculoskeletal (orthopedic)—45%.
- Mental disorders—14%.
- Cardiovascular—8%.
- Blood/skin/endocrine—8%.
- Visual/auditory—7%.

Injuries/musculoskeletal (orthopedic) conditions account for nearly half of all disability cases.

Veterans Administration - Distribution (%) of Total Disability Cases by Two-Digit VASRD Codes,* December 1994



n = 2,221,547.
Other disabilities accounted for < 0.2% of total cases.
* VASRD codes as defined in 38 CFR 4.

Source: Department of Veterans Affairs, National Center for Veteran Analysis and Statistics, Washington, DC, VA Annual Report, 1995.

Figure 4-24

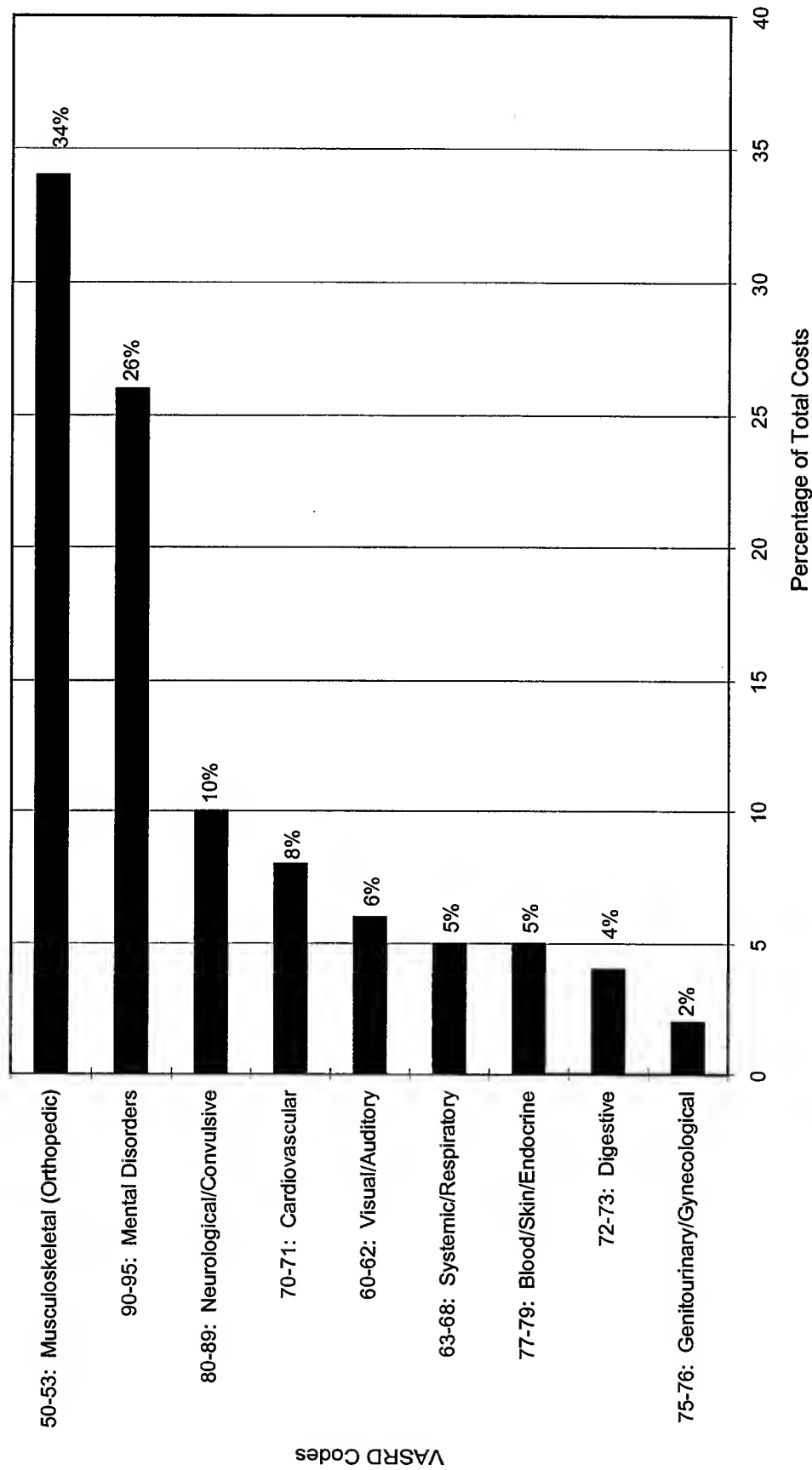
Costs of Disabilities.

Figure 4-25 illustrates the distribution of disability compensation costs by two-digit VASRD codes for December 1994. The top five codes were:

- Musculoskeletal (orthopedic)—34%.
- Mental disorders—26%.
- Neurological/convulsive—10%.
- Cardiovascular—8%.
- Visual/auditory—6%.

Musculoskeletal (orthopedic) conditions account for one third of all disability compensation costs.

Veterans Administration - Distribution (%) of Disability Compensation Costs by Two-Digit VASRD Codes,* December 1994



Total compensation cost is approximately \$1.02 billion.

Other disabilities accounted for < 0.2% of total costs.

* VASRD codes as defined in 38 CFR 4.

Source: Department of Veterans Affairs, National Center for Veteran Analysis and Statistics, Washington, DC, VA Annual Report, 1995.

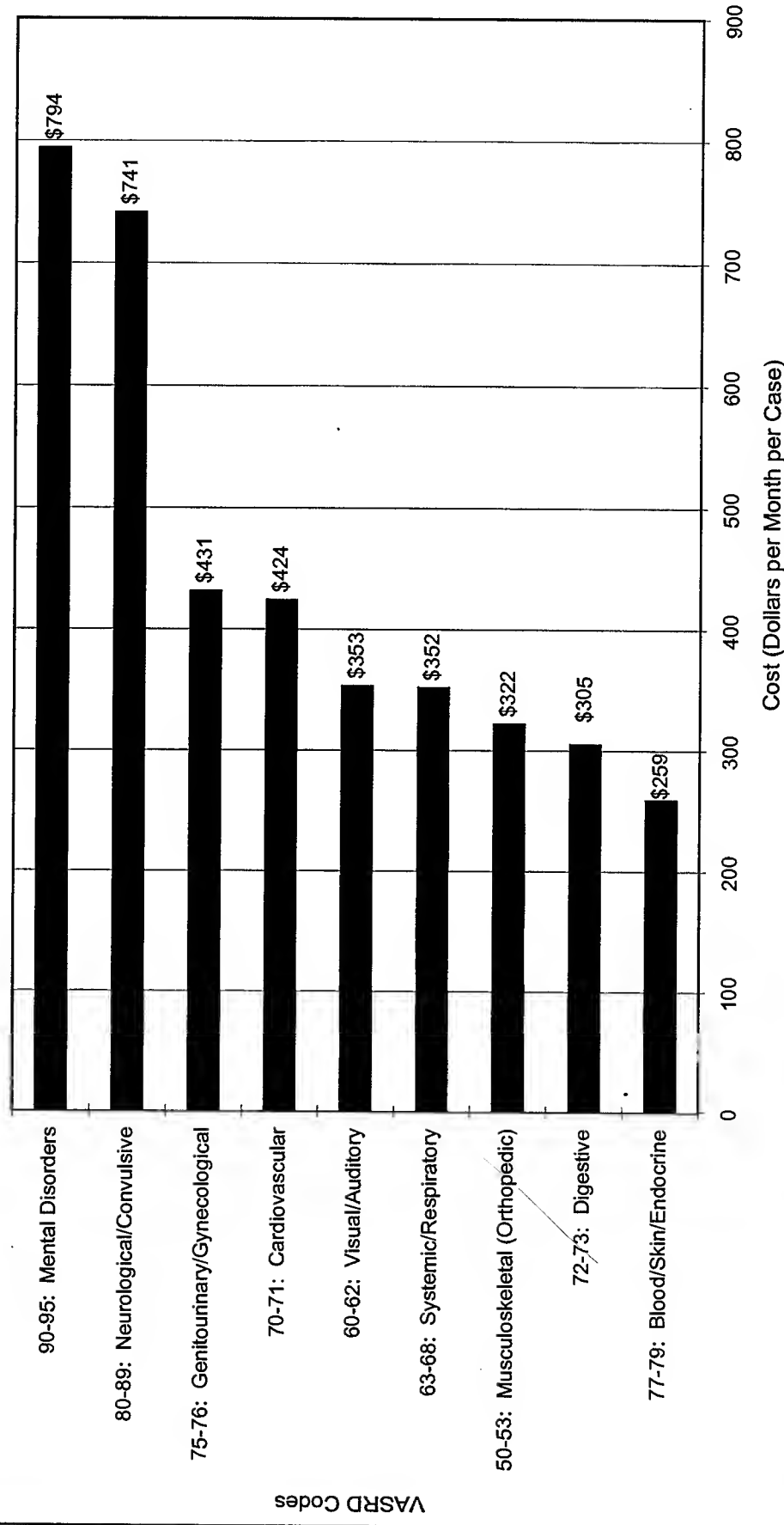
Figure 4-25

Figure 4-26 illustrates the cost per case by two-digit VASRD codes for December 1994. The top five codes were:

- Mental disorders—\$794 per month per case.
- Neurological/convulsive—\$741 per month per case.
- Genitourinary/gynecological—\$431 per month per case.
- Cardiovascular—\$424 per month per case.
- Visual/auditory—\$353 per month per case.

When the cost per case is calculated, there is a more than a three-fold difference between the most expensive cause of disability (mental disorders) and the least expensive cause of disability (blood/skin/endocrine).

Veterans Administration - Cost Per Case* by Two-Digit VASRD Codes,† December 1994



* Overall average cost per case per month = \$443.

† VASRD codes as defined in 38 CFR 4.

Source: Department of Veterans Affairs, National Center for Veteran Analysis and Statistics, Washington, DC, VA Annual Report, 1995.

Figure 4-26

CHAPTER 5

HOSPITALIZATIONS DUE TO INJURY: INPATIENT MEDICAL RECORDS DATA

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Section I. Description of Hospitalization Admission Databases

5-1. Introduction

Each military service maintains an inpatient medical records database that routinely collects and manages information on admissions to their military hospitals during peacetime.

- Army. The hospitalization medical records database, the Individual Patient Data System (IPDS), is managed by the Directorate of Patient Administration Systems and Biostatistics Activity (PASBA), U.S. Army Medical Department Center and School in San Antonio, Texas.
- Navy. The hospitalization medical records database is managed by the Naval Medical Information Management Center (NMIMC) in Bethesda, Maryland.
- Air Force. The hospitalization medical records database is managed by the Air Force Medical Support Agency, Medical Information Systems Division (AFMSA/SGSI) in San Antonio, Texas.

Each military service uses its own database to document and provide hospitalization information as required by Department of Defense Instruction (DoDI) 6040.39 (Reporting of Inpatient Data). Each of these databases include:

- Demographic information such as age, race, gender, and military occupational specialty (MOS).
- Diagnoses using specific discharge diagnoses abstracted from the medical record and then coded according to the ICD-9 codes (see Appendix A, Table A-3).
- Injury type/cause using the STANAG 2050 coding system (see Appendix A, Table A-1).
- Non-effective days on the hospital rolls (i.e., in a hospital bed or on convalescent leave).
- Non-military hospitalizations to capture active duty personnel hospitalized in civilian hospitals.

5-2. Mission

The mission of the administrative organizations that maintain these databases is to operate their respective inpatient medical data collection system in support of DoD and the military service medical departments.

5-3. Purpose

The primary purpose of the hospitalization databases is administrative and includes:

- Patient tracking.
- Provision of information to effectively manage medical resources and efficiently distribute workload.
- Foundation to support future medical planning.

A secondary purpose is the support of medical research, including epidemiological studies. These databases have great potential value for routine medical and injury surveillance which would help to identify trends and high-risk groups and to develop appropriate intervention and prevention strategies.

Since 1989, hospitalization data have been standardized across services by the Standard Inpatient Data Record (SIDR). Although the hospitalization databases were not specifically implemented for the purpose of injury surveillance or prevention, their completeness and standardization fulfills many of the requirements for such a purpose.

5-4. Authority

The authority for collecting hospital data comes from DoDI 6040.39 from which all services generate appropriate directives. Each service may have additional requirements as outlined in their own governing instructions, manuals, or orders.

- Army.
 - Patient Administration (AR 40-400).
- Air Force.
 - AF Policy Directive 41-1, Health Care Programs and Resources.
 - AF Policy Directive 41-2, Medical Support.
 - AF Policy Directive 41-210, Patient Administration Functions.

In addition, there are special forms designed to standardize the data collection:

- Army.
 - Clinical Record, Narrative Summary (SF 502).
 - Clinical Record, Autopsy Protocol (SF 503).
 - Clinical Record, History—Part 1 (SF 504).
 - Clinical Record, Doctor's Progress Notes (SF 509).
 - Hospital Report of Death (DA Form 3894) which is used in hospitals to describe the chain of events leading to death.
 - Inpatient Treatment Record Cover Sheet (DA Form 3647) which includes the diagnosis describing the underlying cause of death.
- Air Force.
 - Authorization and Treatment Statement (AF 560).
 - AF 275 or SFs 502 to 509, as above.
 - Cover Sheet for Patient Record (AF 565).

5-5. Comparison of the Minimum Basic Data Set Variables and Service Hospitalization Databases

Each service identified their database's hospitalization variables for *unintentional injuries* using the questionnaire discussed in Chapter 1 (see pages 1-23 through 1-27). These variables were compared to the MBDS for unintentional injury surveillance recommended by Lund, Holder, and Smith.* A comparison is presented in **Table 5-1**.

The services were not asked to identify their database's hospitalization variables for *intentional injuries*.† Additional data that would be required to satisfy the MBDS for intentional injuries include circumstances or motive surrounding injury event, drugs or alcohol involved, weapon(s) involved, relationship and demographics of victim and perpetrator, and source of data.

¹ Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994.

² Powell, K. and J. Kraus. Minimum Basic Data Set, Intentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:35-1 to 35-2, 1994.

Table 5-1. Comparison of the Recommended Elements for the Minimum Basic Data Set for Unintentional Injury Surveillance and Their Availability from Service Hospitalization Databases

Variables	Army Patient Administration Systems and Biostatistics Activity (PASBA)	Naval Medical Information Management Center (NMIMC)	Air Force Medical Support Agency, Medical Information Systems Division (AFMSA/SGSI)
Intent*	Y	Y	Y
Age of Injured*	Y	Y	Y
Gender*	Y	Y	Y
Race*	Y	Y	Y
Place of Residence*	NS	NS	NS
Date of Injury Event*	N	N	N
Place of Occurrence (on/off duty)*	Y	N	Y
Address of Place of Occurrence*	NS	NS	NS
Activity when Injury Occurred*	Y	N	Y
Mechanism of Accident/Event*	Y	N	Y
Type of Injury/Body Location*	Y	Y	Y
Outcome of Injury			
Type of Treatment†	Y	Y	Y
Dates of Treatment†	N	U	Y

Table 5-1.—Continued

Variables	Army - Patient Administration Systems and Biostatistics Activity (PASBA)	Naval Medical Information Management Center (NMIMC)	Air Force Medical Support Agency, Medical Information Systems Division (AFMSA/SGSI)
Date Admitted to Hospital†	Y	Y	Y
Date Discharged from Hospital†	Y	Y	Y
Nature of Disability†	N	U	N
Degree of Disability (fit for duty, temporary disability retirement list, etc.)†	N	U	N
Severity of Injury†	Y	U	N
Days of Limited Duty†	N	U	N
Days in Hospital†	Y	Y	Y
Costs of Treatment†	Y	U	Y

Y = available in database.

N = not in database.

U = unknown; response not provided on questionnaire.

NS = not solicited on questionnaire.

* Recommended variables for databases designed for unintentional injury surveillance (Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994).

† Example of an outcome variable deemed appropriate for databases with potential for surveillance of unintentional injuries to U.S. active duty military personnel.

Section II. Hospitalization Data: Injuries and Other Causes of Hospitalization

5-6. Army

The Army hospitalization data are presented in four parts:

- The Army Summary. The Army hospitalization data presented in this section are summarized in three tables.
 - The overall summary is presented in Table 5-2.
 - The data in figures 5-1 and 5-2 are summarized in Table 5-3.
 - The data in figures 5-10, 5-12, and 5-13 are summarized in Table 5-4.
- Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.
 - The distribution of hospitalizations and non-effective days due to hospitalization by principal diagnosis group for CY 1994 are displayed in figures 5-1 and 5-2, respectively.
 - The distribution of top 10 injuries and musculoskeletal system diseases by ICD-9 codes for hospitalized personnel for CY 1994 are displayed in figures 5-3 and 5-4, respectively.
- Trends of Army Total Hospitalizations Over Time.
 - The rates of hospitalization by year for CY 1981-1994 are displayed in Figure 5-5.
 - The rates of hospitalization by top 10 principal diagnosis groups for all personnel, men, and women for CY 1981-1994 are displayed in figures 5-6, 5-7, and 5-8, respectively.
 - The rates of hospitalization for musculoskeletal system diseases and injuries by principal diagnosis group for men and women for CY 1981-1994 are displayed in Figure 5-9.
 - The frequency, case rates, and non-effective rates (NERs) by principal diagnosis group for hospitalized men and women for CY 1994 are displayed in Table 5-5.

- Hospitalization by External Cause of Injury.
- The distribution of hospitalizations by external cause of injury for CY 1994 is displayed in Figure 5-10.
- The rates and NERs for hospitalization by external cause of injury for CY 1981-1994 are displayed in figures 5-11, 5-12, and 5-13.
- The frequency, case rates, NERs by external cause of injury for hospitalized men and women for CY 1994 are displayed in Table 5-6.

In addition, Operations Desert Shield and Storm hospitalization data for 1 August 1990 - 31 July 1991 are presented in Supplement A.

The Army Summary.

Table 5-2. Overall Summary of Army Hospitalization Data for Active Duty Personnel

Year	Army Population	Hospitalizations		Rates and Trends of Hospitalizations		Conclusion
		Total	n/1,000 Personnel /Year	n/1,000 Personnel /Year	Trend, % Change (CY 1981-1994)	
CY81-94 CY94	— 550,107	— 84,086	— 153	142 (CY81) —	153 (CY94) —	Rates remained relatively constant.

Denominator Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Table 5-3. Summary of Army Hospitalization Distribution Data by Principal Diagnosis Group, CY 1994

Principal Diagnosis Groups	ICD-9 Codes	Distribution (%)		Conclusions
		Hospitalizations (n = 84,086)	Non-Effective Days (n = 802,400)	
Musculoskeletal System	710-739	18%	23%	Musculoskeletal System • Musculoskeletal system diseases, which are largely late, recurrent, or chronic effects of injuries, were the leading cause of hospitalizations and hospitalization associated non-effective days in CY 1994. Digestive System • Digestive system diseases were the second leading cause of hospitalization. Injury • Injuries were the third leading cause of hospitalizations and hospital-related non-effective days. Mental Disorders • Interestingly, the second leading cause of hospitalization associated non-effective days was mental disorders even though mental disorders were only the sixth cause of hospitalization.
Digestive System	520-579	12%	6%	
Injury	800-999	10%	12%	
Pregnancy	630-676	9%	8%	
Respiratory System	460-519	9%	4%	
Mental Disorders	290-319	8%	18%	
Genitourinary System	580-629	5%	3%	
Infectious & Parasitic	001-139	5%	3%	
V Codes*	V01-V82	4%	3%	
Ill-Defined Conditions	780-799	4%	3%	
Other (includes groups less than 3% each)	—	16%	17%	

* Circumstances recorded as diagnoses or problems, but not classified as a disease, injury, or E code.

Table 5-4. Summary of Army Hospitalization Data by External Cause of Injury, CY 1994

External Causes of Injury*	Distribution (%) of Hospitalizations (n = 13,002)	Rates Per 1,000 Personnel		Conclusions
		Hospitalizations	NER†	
Complications of Medical/Surgical Procedures	15%	3.6	0.19	<ul style="list-style-type: none"> • About one-third of external causes of hospitalization are due to late effects of injury or complications of medical/surgical procedures. • About two-thirds of external causes of hospitalization represent acute injuries. • Athletics/sports injuries are the leading specific nonmedical cause of injuries. • Motor vehicle accidents are the fourth leading cause of injury hospitalizations, but have the highest NER.
Late Effects of Injury	15%	3.5	0.21	
Athletics/Sports Injuries	12%	2.8	0.07	
Motor Vehicle Accidents	11%	2.6	0.18	
Falls/Jumps	8%	1.8	0.06	
Poisoning by Ingestion	5%	1.1	0.03	
Machinery/Tools	5%	1.1	0.03	
Cut/Pierce by Objects	4%	1.0	0.02	
Military Air Transport Accidents	—	0.9	0.02	
Fighting	—	0.7	0.02	
Unknown Causative Agent	6%	—	—	
Other (includes diagnoses accounting for less than 4%)	19%	—	—	

* NATO STANAG codes.

† Non-effective rate = number of persons on the hospital rolls per 1,000 personnel per year.

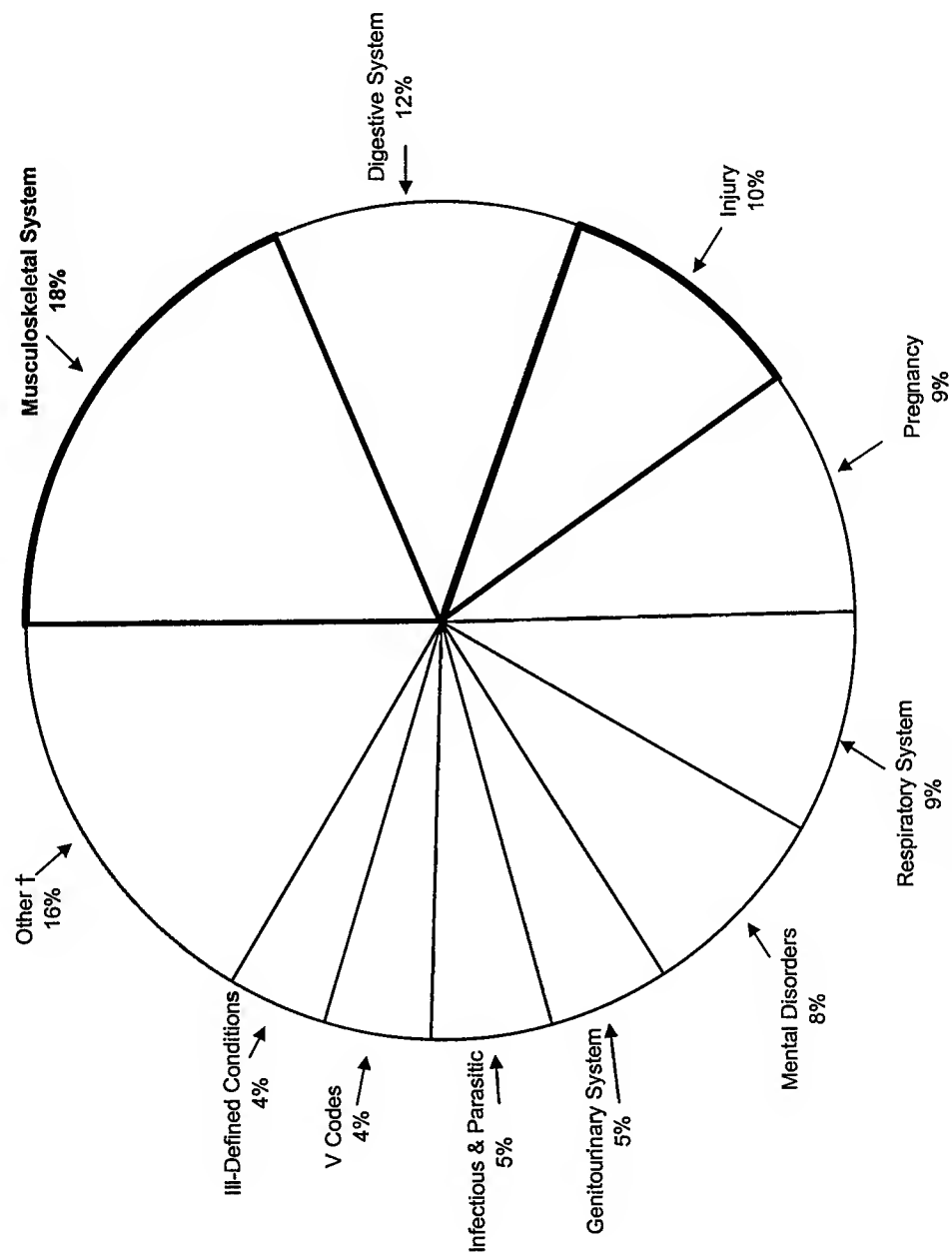
Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.

Figure 5-1 illustrates the distribution of 84,086 hospitalizations by principal diagnosis group for active duty Army personnel for CY 1994. The top five contributors to hospitalization were:

- Musculoskeletal system (ICD-9 codes 710-739)—18%.
- Digestive system (ICD-9 codes 520-579)—12%.
- Injury (ICD-9 codes 800-999)—10%.
- Pregnancy (ICD-9 codes 630-676)—9%.
- Respiratory system (ICD-9 codes 460-519)—9%.

When hospitalizations coded under the musculoskeletal system and injury diagnosis groups are combined to fully examine the contribution of injuries to total hospitalizations, it is evident that injury-related events may account for nearly 30% of all hospitalizations.

Army - Distribution (%) of Hospitalizations by Principal Diagnosis Group,* CY 1994



n = 84,086.

* Principal diagnosis groups from the *International Classification of Diseases*, 9th edition.

† Other includes diagnosis groups accounting for less than 3% each.

Source: Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-1

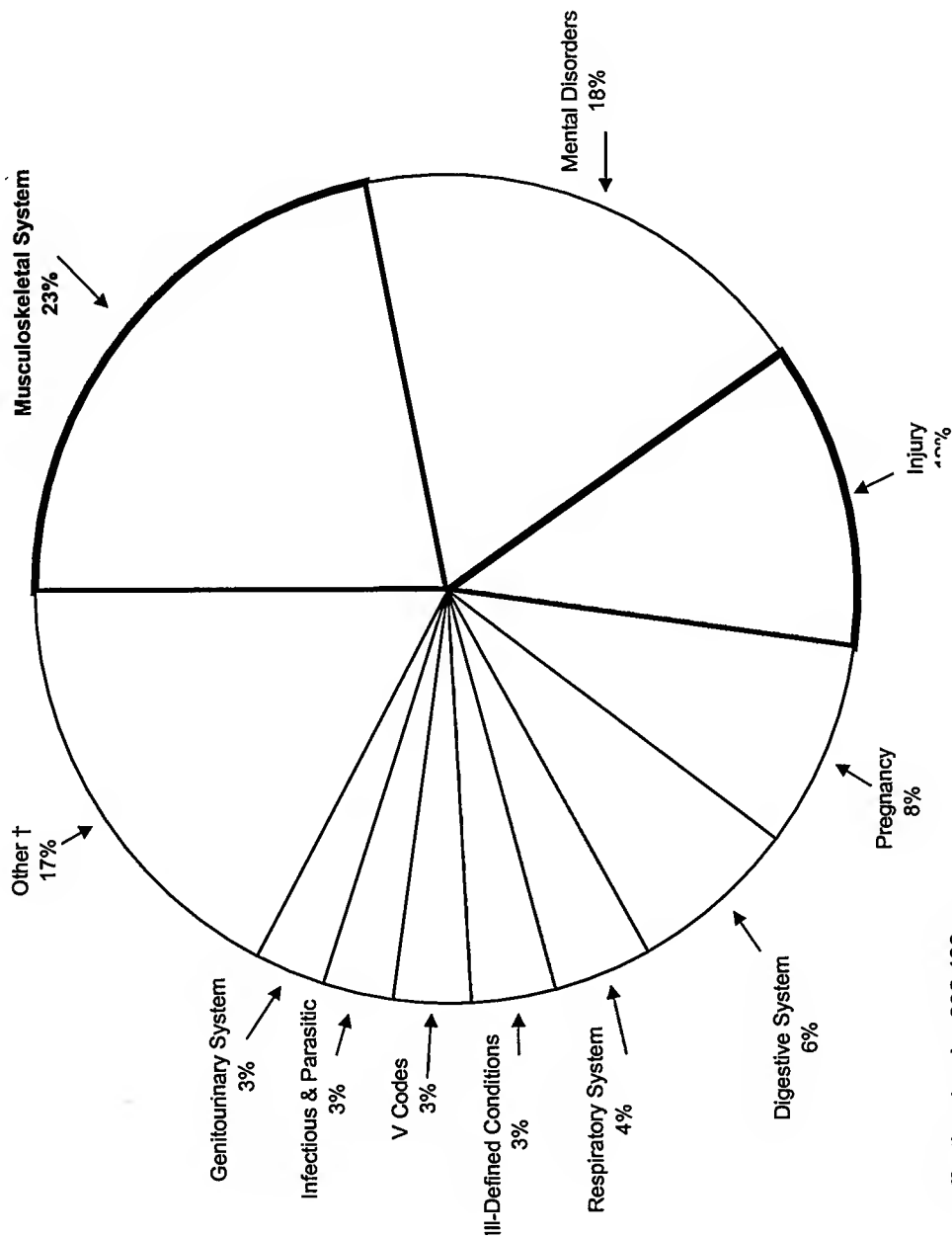
Figure 5-2 illustrates the distribution of non-effective days due to hospitalization by principal diagnosis group for active duty Army personnel for CY 1994. The total number of non-effective days was approximately 802,400.

The number of non-effective days are routinely converted to NERs, which provide an indication of the impact of illness or injury. NERs are defined as the number of persons on the hospital rolls per 1,000 personnel per day and are a function of both the number of hospitalizations and the average length of hospital stays for any given group of diagnoses. The total NER for CY 1994 was 1,515.5 days per 1,000 personnel, with the following top five contributors to non-effective days:

- Musculoskeletal system (ICD-9 codes 710-739)—23%.
- Mental disorders (ICD-9 codes 290-319)—18%.
- Injury (ICD-9 codes 800-999)—12%.
- Pregnancy (ICD-9 codes 630-676)—8%.
- Digestive system (ICD-9 codes 520-579)—6%.

When musculoskeletal system and injury diagnosis groups are combined, it is likely that injury-related events account for 35% of all non-effective days.

Army - Distribution (%) of Non-Effective Days Due to Hospitalization by Principal Diagnosis Group,* CY 1994



n (approximate number of non-effective days) = 802,400.
 * Principal diagnosis groups from the *International Classification of Diseases*, 9th edition.
 † Other includes diagnosis groups accounting for less than 3%.

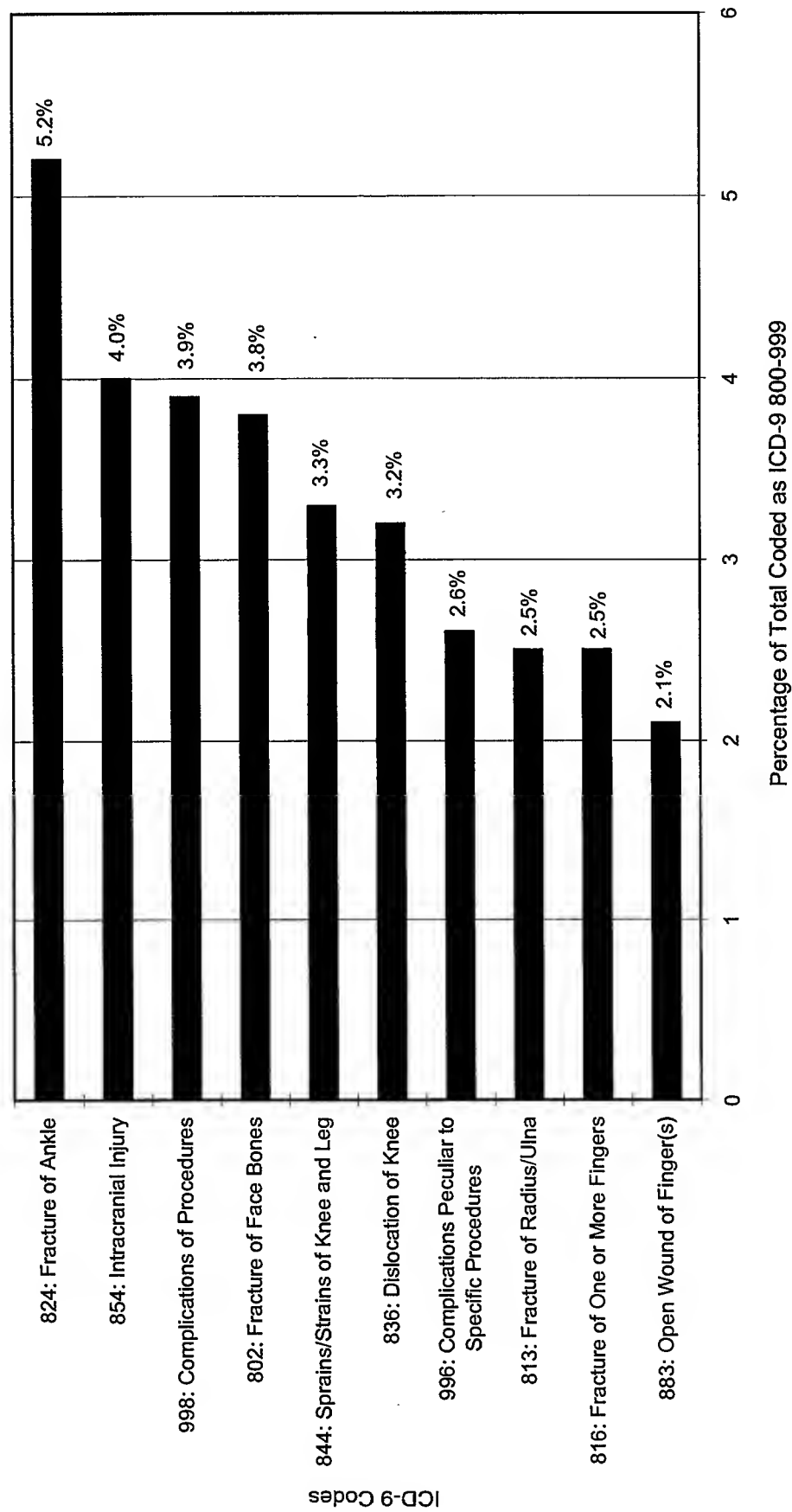
Source: Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-2

Figure 5-3 illustrates the distribution of the top 10 injuries (ICD-9 codes 800-999) for active duty Army hospitalized personnel for CY 1994. The top five contributors to injury hospitalization were:

- Fracture of the ankle—5.2%.
- Intracranial injury—4.0%.
- Other complications of medical or surgical procedures not elsewhere classified—3.9%.
- Fracture of the face bones—3.8%.
- Sprains and strains of the knee and leg—3.3%.

Army - Distribution (%) of the Top 10 Injuries* (ICD-9 Codes 800-999) for Hospitalized Personnel, CY 1994



n = 8,677.

* Top 10 injuries account for 33% of all injuries.

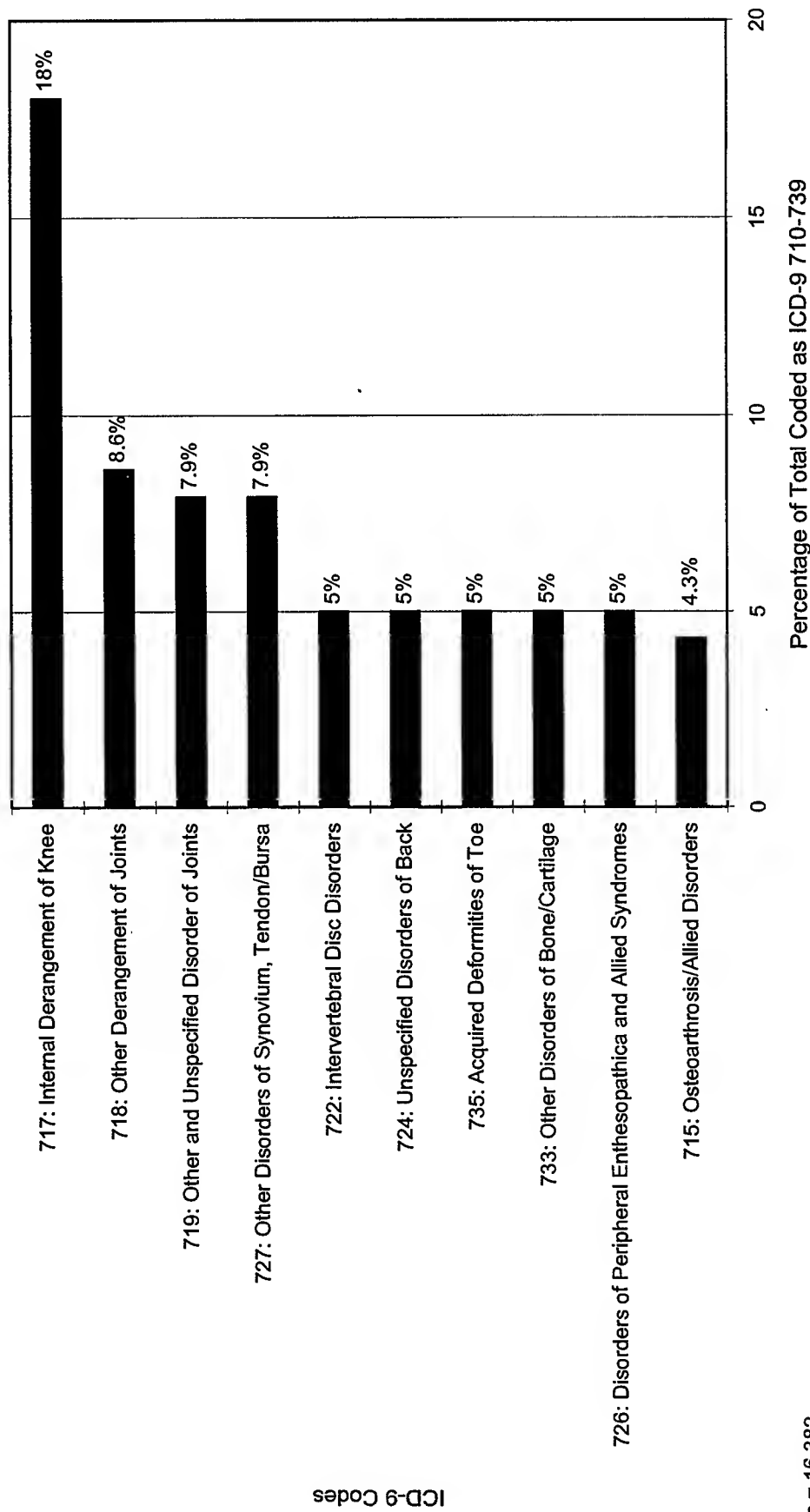
Source: Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-3

Figure 5-4 illustrates the distribution of the top 10 musculoskeletal system diseases (ICD-9 codes 710-739) for active duty Army hospitalized personnel for CY 1994. The top five contributors to hospitalization were:

- Internal derangement of the knee—18.0%.
- Other derangement of joints—8.6%.
- Other and unspecified disorders of joints—7.9%.
- Other disorders of synovium, tendon and bursa—7.9%.
- Intervertebral disc disorders, unspecified disorders of back, acquired deformities of toe, other disorders of bone and cartilage, and disorders of peripheral enthesopathica and allied syndromes—5.0% each.

Army - Distribution (%) of the Top 10 Musculoskeletal System Diseases* (ICD-9 Codes 710-739) for Hospitalized Personnel, CY 1994



n = 16,382.

* Top 10 musculoskeletal system diseases account for nearly 72% of all musculoskeletal system diseases (11,815/16,382 cases).

Source: Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-4

Trends of Army Total Hospitalizations Over Time.

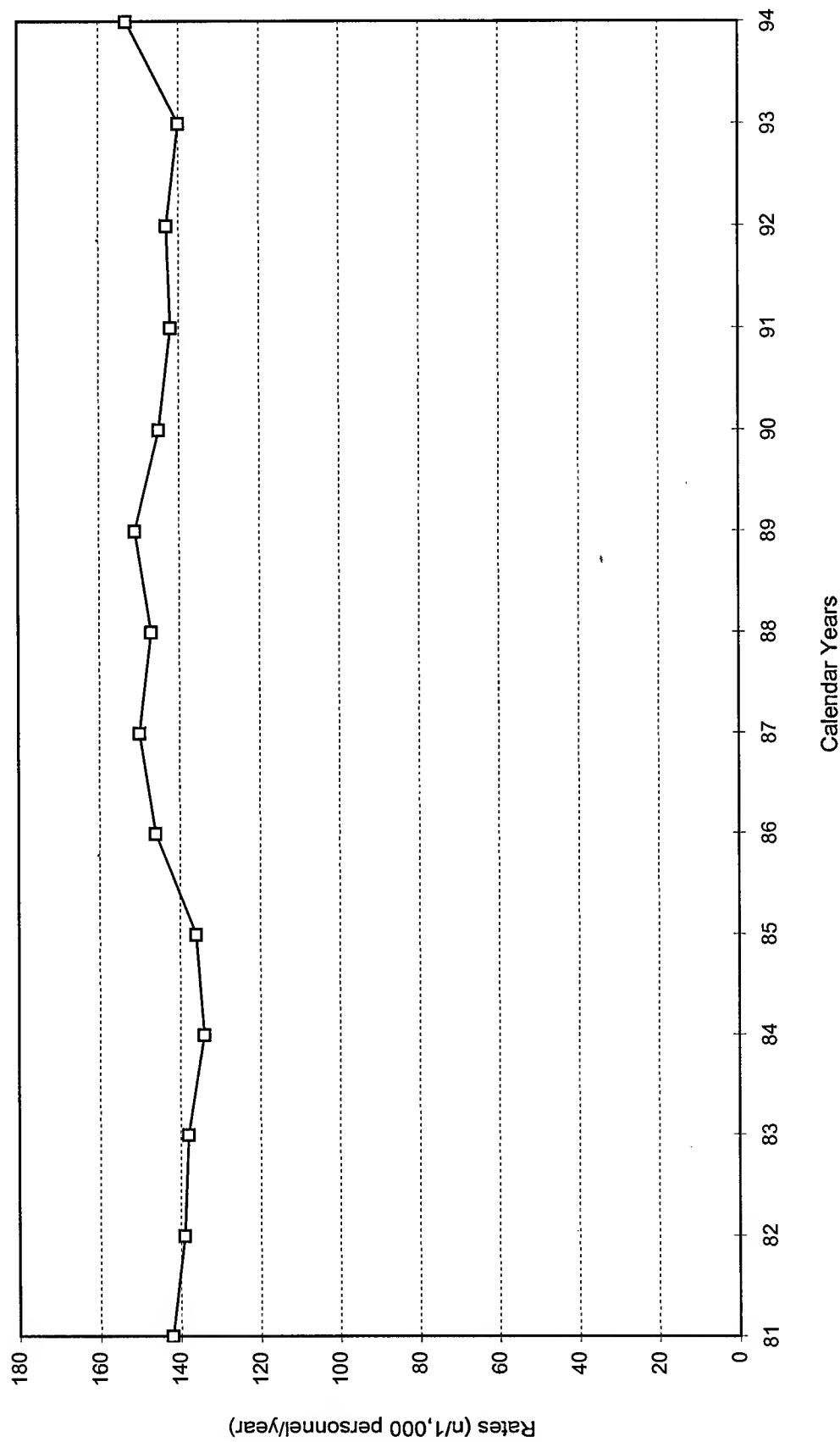
Figure 5-5 illustrates the rates of hospitalization by year for active duty Army personnel for CY 1981-1994. Hospitalization rates increased 8% from 142 per 1,000 personnel in CY 1981 to 153 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-5

Army - Rates of Hospitalization by Calendar Year*													
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
142	139	138	134	136	146	150	147	151	145	142	143	140	153

* Rates per 1,000 personnel.

Army - Rates of Hospitalization by Year, CY 1981-1994



Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-5

Figure 5-6 illustrates the rates of hospitalization for the top 10 principal diagnosis groups for active duty Army personnel for CY 1981-1994.

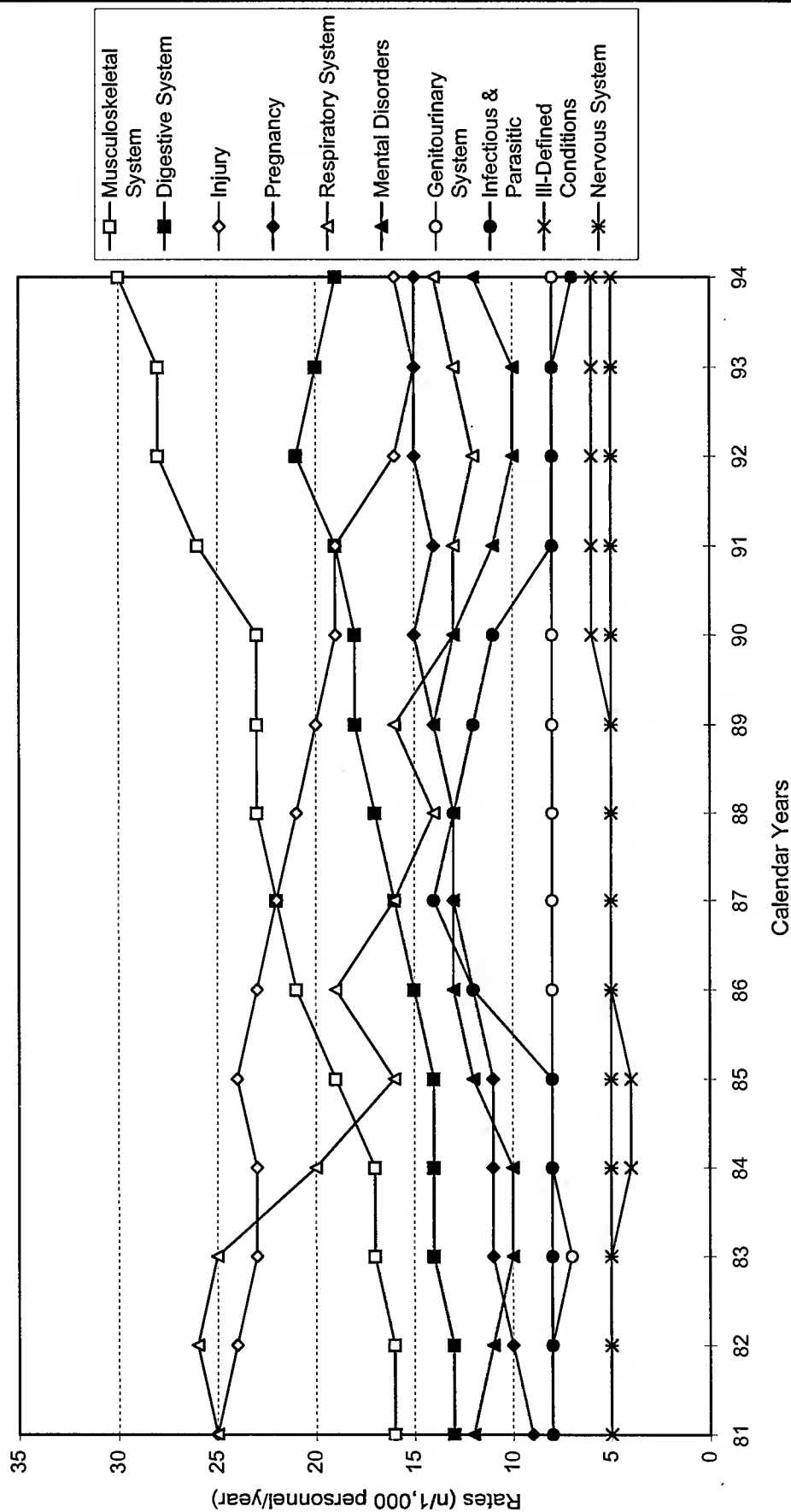
- Musculoskeletal system hospitalization rates increased 88% from 16 per 1,000 personnel in CY 1981 to 30 per 1,000 personnel in CY 1994.
- Digestive system hospitalization rates increased 46% from 13 per 1,000 personnel in CY 1981 to 19 per 1,000 personnel in CY 1994.
- Injury hospitalization rates decreased 36% from 25 per 1,000 personnel in CY 1981 to 16 per 1,000 personnel in CY 1994.
- Pregnancy hospitalization rates increased 67% from 9 per 1,000 personnel in CY 1981 to 15 per 1,000 personnel in CY 1994.
- Respiratory system hospitalization rates decreased 44% from 25 per 1,000 personnel in CY 1981 to 14 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-6

Principal Diagnosis Groups (Rank Based on 1994 Data)	ICD-9 Codes	Army - Rates of Hospitalization by Calendar Year*													
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Musculoskeletal System	710-739	16	16	17	17	19	21	22	23	23	23	26	28	28	30
Digestive System	520-579	13	13	14	14	14	15	16	17	18	18	19	21	20	19
Injury	800-999	25	24	23	23	24	23	22	21	20	19	19	16	15	16
Pregnancy	630-676	9	10	11	11	11	12	13	13	14	15	14	15	15	15
Respiratory System	460-519	25	26	25	20	16	19	16	14	16	13	13	12	13	14
Mental Disorders	290-319	12	11	10	10	12	13	13	13	14	13	11	10	10	12
Genitourinary System	580-629	8	8	7	8	8	8	8	8	8	8	8	8	8	8
Infectious & Parasitic	001-139	8	8	8	8	8	12	14	13	12	11	8	8	8	7
III-Defined Conditions	780-799	5	5	5	4	4	5	5	5	5	6	6	6	6	6
Nervous System	320-389	5	5	5	5	5	5	5	5	5	5	5	5	5	5

* Rates per 1,000 personnel.

Army - Rates of Hospitalization for the Top 10 Principal Diagnosis Groups,* CY 1981-1994



* Principal diagnosis groups from the *International Classification of Diseases*, 9th edition.

Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-6

Figure 5-7 illustrates the rates of hospitalization for the top 10 principal diagnosis groups for active duty Army men for CY 1981-1994.

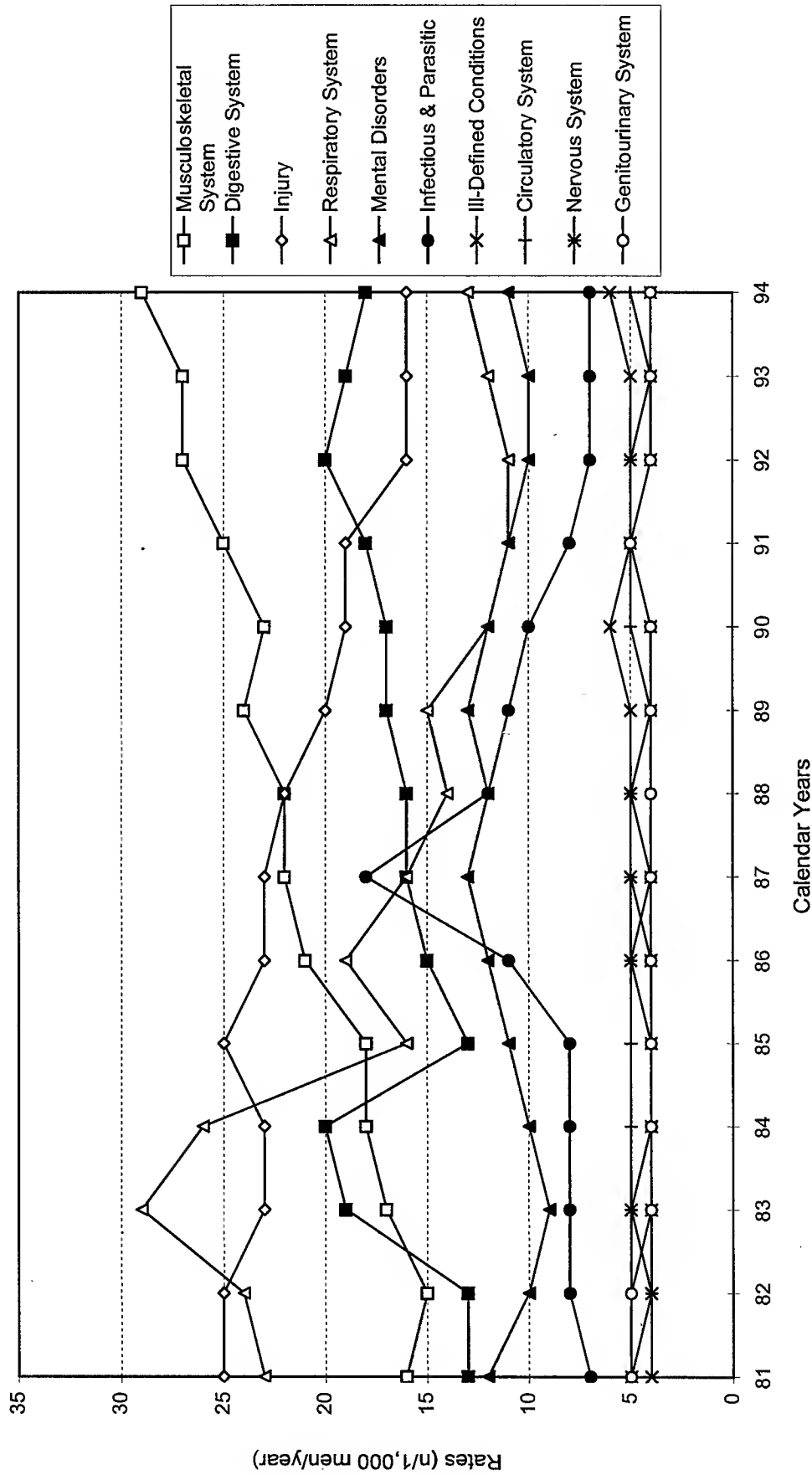
- Every year from CY 1981 to 1994, both the musculoskeletal system and injury principal diagnosis groups were among the top three hospitalization rates for men.
- Musculoskeletal system hospitalization rates for men increased 81% from 16 per 1,000 personnel in CY 1981 to 29 per 1,000 personnel in CY 1994.
- Digestive system hospitalization rates for men increased 38% from 13 per 1,000 personnel in CY 1981 to 18 per 1,000 personnel in CY 1994.
- Injury hospitalization rates decreased 36% from 25 per 1,000 personnel in CY 1981 to 16 per 1,000 personnel in CY 1994.
- Respiratory system hospitalization rates for men decreased 44% from 23 per 1,000 personnel in CY 1981 to 13 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-7

Principal Diagnosis Groups (Rank Based on 1994 Data)	ICD-9 Codes	Army - Rates of Hospitalization by Calendar Year*													
		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Musculoskeletal System	710-739	16	15	17	18	18	21	22	22	24	23	25	27	27	29
Digestive System	520-579	13	13	19	20	13	15	16	16	17	17	18	19	19	18
Injury	800-999	25	25	23	23	25	23	23	22	20	19	19	16	16	16
Respiratory System	460-519	23	24	29	26	16	19	16	14	15	12	11	11	12	13
Mental Disorders	290-319	12	10	9	10	11	12	13	12	13	12	11	10	10	11
Infectious & Parasitic	001-139	7	8	8	8	8	11	18	12	11	10	8	7	7	7
III-Defined Conditions	780-799	4	4	5	4	4	4	5	5	5	6	5	5	5	6
Circulatory System	390-459	5	5	5	5	5	5	5	5	4	5	5	5	4	5
Nervous System	320-389	5	4	4	4	4	5	4	5	4	4	5	4	4	4
Genitourinary System	580-629	5	5	4	4	4	4	4	4	4	4	5	4	4	4

* Rates per 1,000 personnel.

Army - Rates of Hospitalization for the Top 10 Principal Diagnosis Groups* for Men, CY 1981-1994



* Principal diagnosis groups from the *International Classification of Diseases*, 9th edition.

Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-7

Figure 5-8 illustrates the rates of hospitalization for the top 10 principal diagnosis groups for active duty Army women for CY 1981-1994.

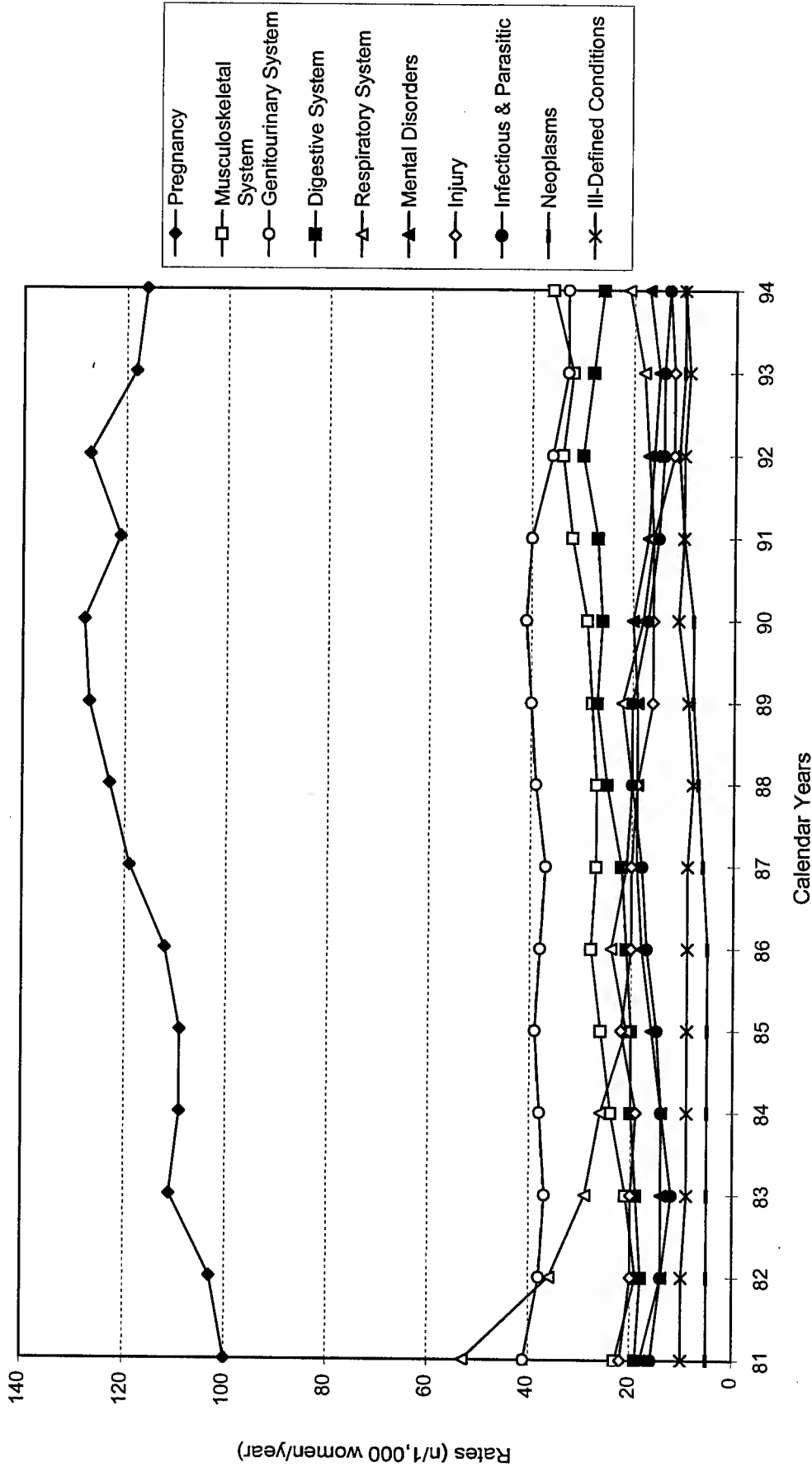
- Every year from CY 1981 to 1994, musculoskeletal system diseases were among the top four hospitalization rates for women.
- Each year, the hospitalization rate for pregnancy ranked the highest. For the entire period, there appears to be a slight increase in rates.
- Musculoskeletal system hospitalization rates for women increased 57% from 23 per 1,000 personnel in CY 1981 to 36 per 1,000 personnel in CY 1994.
- Respiratory system hospitalization rates for women decreased 60% from 53 per 1,000 personnel in CY 1981 to 21 per 1,000 personnel in CY 1994.
- Injury hospitalization rates for women decreased 41% from 22 per 1,000 personnel in CY 1981 to 13 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-8

Principal Diagnosis Groups (Rank Based on 1994 Data)		ICD-9 Codes	Army - Rates of Hospitalization by Calendar Year*													
			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	Pregnancy	630-676	100	103	111	109	109	112	119	123	127	128	121	127	118	116
	Musculoskeletal System	710-739	23	19	21	24	26	28	27	27	28	29	32	34	32	36
	Genitourinary System	580-629	41	38	37	38	39	38	37	39	40	41	40	36	33	33
	Digestive System	520-579	19	18	19	20	20	21	22	25	27	26	27	30	28	26
	Respiratory System	460-519	53	36	29	26	21	24	21	20	22	18	16	17	18	21
	Mental Disorders	290-319	18	14	14	14	16	18	19	19	19	20	17	16	15	17
	Injury	800-999	22	20	20	19	22	20	20	19	16	16	16	12	12	13
	Infectious & Parasitic	001-139	16	14	12	14	15	17	18	20	20	17	15	14	14	13
	Neoplasms	140-239	5	5	5	5	5	5	6	7	8	8	10	11	10	10
	Ill-Defined Conditions	780-799	10	10	9	9	9	9	9	8	9	11	10	10	9	10

* Rates per 1,000 personnel.

Army - Rates of Hospitalization for the Top 10 Principal Diagnosis Groups* for Women, CY 1981-1994



* Principal diagnosis groups from the *International Classification of Diseases*, 9th edition.

Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-8

Figure 5-9 illustrates the rates of hospitalization for musculoskeletal system diseases and injuries for active duty Army men and women by principal diagnosis group for CY 1981-1994.

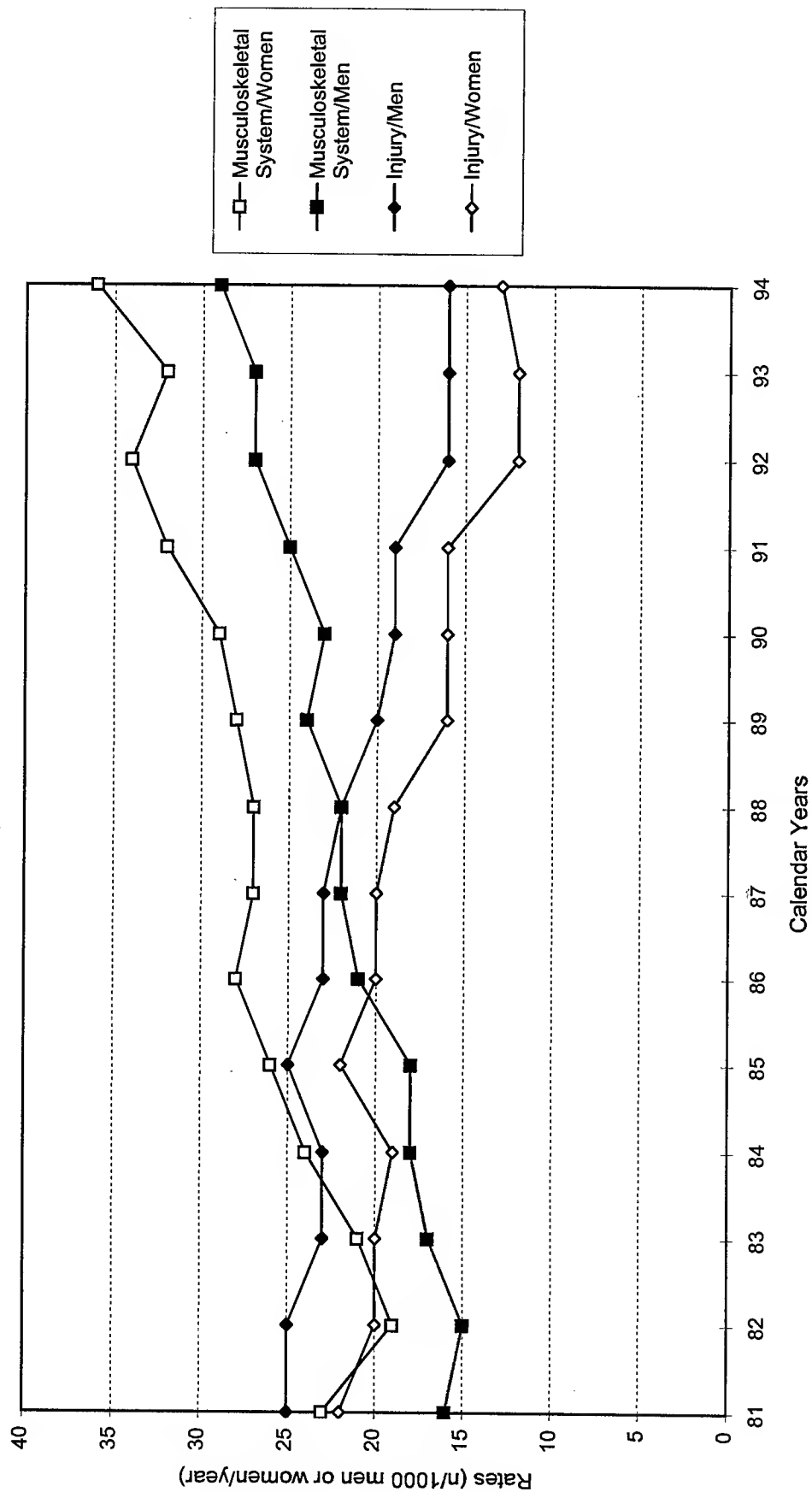
- Musculoskeletal system condition rates for women increased 57% from 23 per 1,000 personnel in CY 1981 to 36 per 1,000 personnel in CY 1994.
- Musculoskeletal system condition rates for men increased 81% from 16 per 1,000 personnel in CY 1981 to 29 per 1,000 personnel in CY 1994.
- Injury rates for men decreased 36% from 25 per 1,000 personnel in CY 1981 to 16 per 1,000 personnel in CY 1994.
- Injury rates for women decreased 41% from 22 per 1,000 personnel in CY 1981 to 13 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-9

Worksheet Data for Figure 5-9														
Principal Diagnosis Groups (Rank Based on 1994 Data)	Army - Rates of Hospitalization by Calendar Year*													
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Musculoskeletal System/Women	23	19	21	24	26	28	27	27	28	29	32	34	32	36
Musculoskeletal System/Men	16	15	17	18	18	21	22	22	24	23	25	27	27	29
Injury/Men	25	25	23	23	25	23	23	22	20	19	19	16	16	16
Injury/Women	22	20	20	19	22	20	20	19	16	16	16	12	12	13

* Rates per 1,000 personnel.

Army - Rates of Hospitalization for the Musculoskeletal System and Injury Principal Diagnosis Groups* for Men and Women, CY 1981-1994



*Principal diagnosis groups from the *International Classification of Diseases*, 9th edition.

Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-9

Table 5-5 displays the frequency, case rate, and NER data by principal diagnosis group for hospitalized active duty Army men and women for CY 1994.

- The top three hospitalization rates for men were:
 - Musculoskeletal system—28.89.
 - Digestive system—17.84.
 - Injury—16.19.
- The top three hospitalization rates for women were:
 - Pregnancy—115.77.
 - Musculoskeletal system—35.86.
 - Genitourinary system—33.47.
- The top three NERs for men were:
 - Musculoskeletal system—326.00.
 - Mental disorders—278.20.
 - Injury—192.27.
- The top three NERs for women were:
 - Pregnancy—965.20.
 - Musculoskeletal system—363.33.
 - Mental disorders—286.11.
- Excluding pregnancy, musculoskeletal system diseases were the leading cause of hospitalizations and non-effective days for both men and women.
- Case rates and NERs for injuries ranked third for men and eighth for women.

Table 5-5. Army - Frequency (n), Case Rates, and Non-Effective Rates by Principal Diagnosis Group for Hospitalized Active Duty Men and Women, CY 1994

Principal Diagnosis Groups	ICD-9 Codes	Men			Women			Total		
		n	Case Rate*	NER†	n	Case Rate	NER	n	Case Rate	NER
Musculoskeletal System	710-739	13,853	28.89	326.00	2,529	35.86	363.33	16,382	29.78	330.79
Digestive System	520-579	8,558	17.84	92.28	1,815	26.74	138.41	10,373	18.86	98.19
Injury	800-999	7,762	16.19	192.27	915	12.98	115.88	8,677	16.77	182.47
Pregnancy	630-676	0	0	0	8,164	115.77	965.20	8,165	14.84	122.45
Respiratory System	460-519	6,194	12.92	58.37	1,453	20.60	87.69	7,647	13.90	62.13
Mental Disorders	290-319	5,425	11.31	278.20	1,229	17.43	286.11	6,654	12.10	279.21
Genitourinary System	580-629	1,929	4.02	22.30	2,360	33.47	168.62	4,289	7.80	41.05
Infectious & Parasitic	001-139	3,171	6.61	39.13	898	12.73	62.88	4,069	7.40	42.17
V Codes‡	V01-V82	2,384	4.97	40.99	1,167	16.55	81.59	3,551	6.46	46.19
Ill-Defined Conditions	780-799	2,786	5.81	43.19	680	9.64	80.71	3,466	6.30	48.00
Nervous System	320-389	2,080	4.34	80.92	567	8.04	81.69	2,647	4.81	81.02
Circulatory System	390-459	2,334	4.87	60.88	303	4.30	36.53	2,637	4.79	57.76
Neoplasms	140-239	1,332	2.78	55.32	719	10.20	128.33	2,051	3.73	64.68
Skin & Breast	680-709	1,624	3.39	23.74	302	4.28	26.27	1,926	3.50	23.94
Congenital Anomalies	740-759	559	1.17	12.68	108	1.53	20.60	667	1.21	13.69
Endocrine, Nutritional, Metabolic	240-279	460	0.96	16.85	184	2.61	17.07	644	1.71	16.88
Blood & Blood-Forming Organs	280-289	167	0.35	4.14	74	1.05	10.04	241	0.44	4.90
Totals	—	60,618	126.42	1,347.26	23,467	333.78	2,670.95	84,086	154.40	1,515.52

* Case rate = number of persons hospitalized per 1,000 personnel per year.

† NER = number of persons on the hospital rolls per 1,000 personnel per year.

‡ Circumstances recorded as diagnoses or problems, but not classified as a disease, injury, or E code.

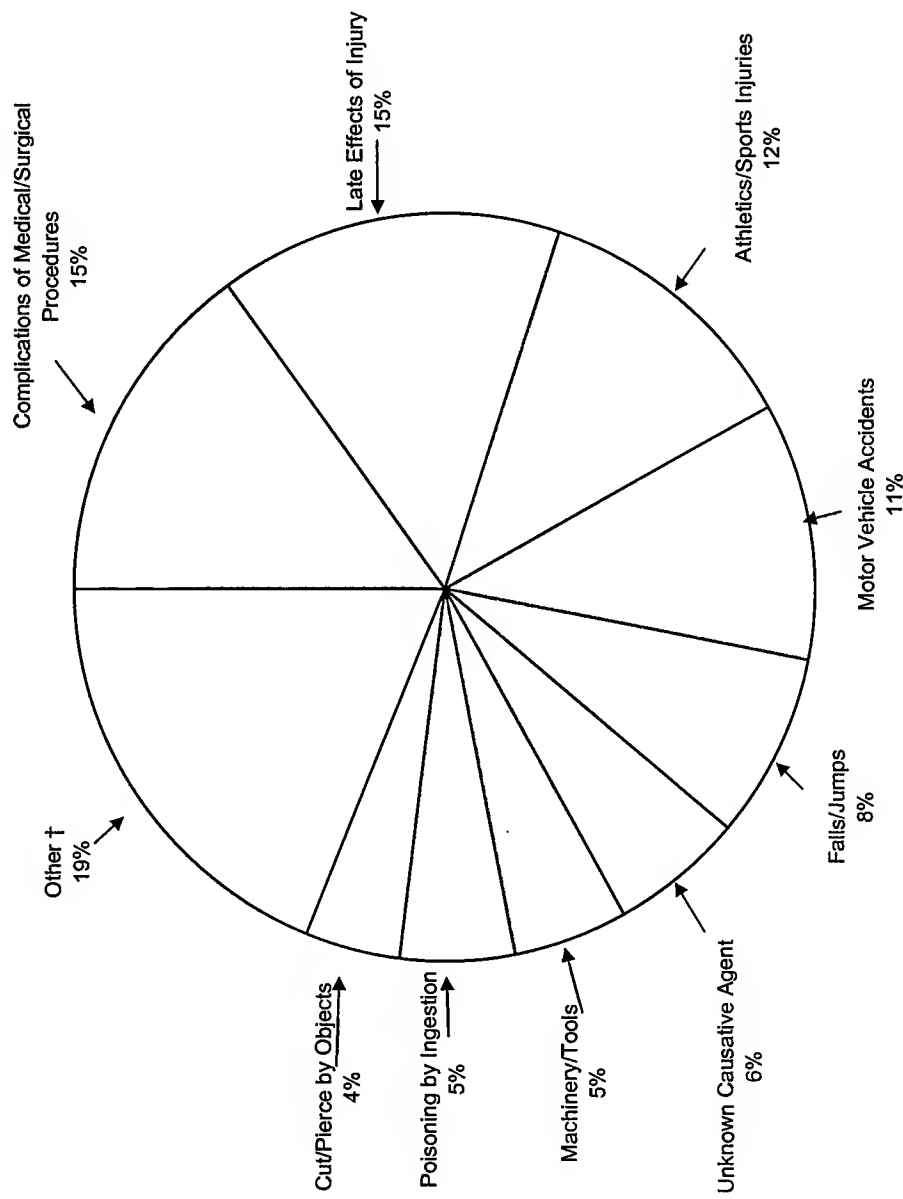
Source: Army Medical Surveillance Activity, USACHPPM, 1996.

Hospitalizations by External Causes of Injury.

Figure 5-10 illustrates the distribution of hospitalizations by external cause of injury for active duty Army personnel for CY 1994. Of a total of 13,002 hospitalizations, the top five causes were:

- Complications of medical or surgical procedures—15%.
- Late effects of injury—15%.
- Athletics and sports injuries—12%.
- Motor vehicle accidents—11%.
- Falls and jumps—8%.

Army - Distribution (%) of Hospitalizations by External Cause of Injury,* CY 1994



n = 13,002.

* NATO Standard Agreement (STANAG) codes.

† Other includes diagnosis groups accounting for less than 4%.

Source: Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-10

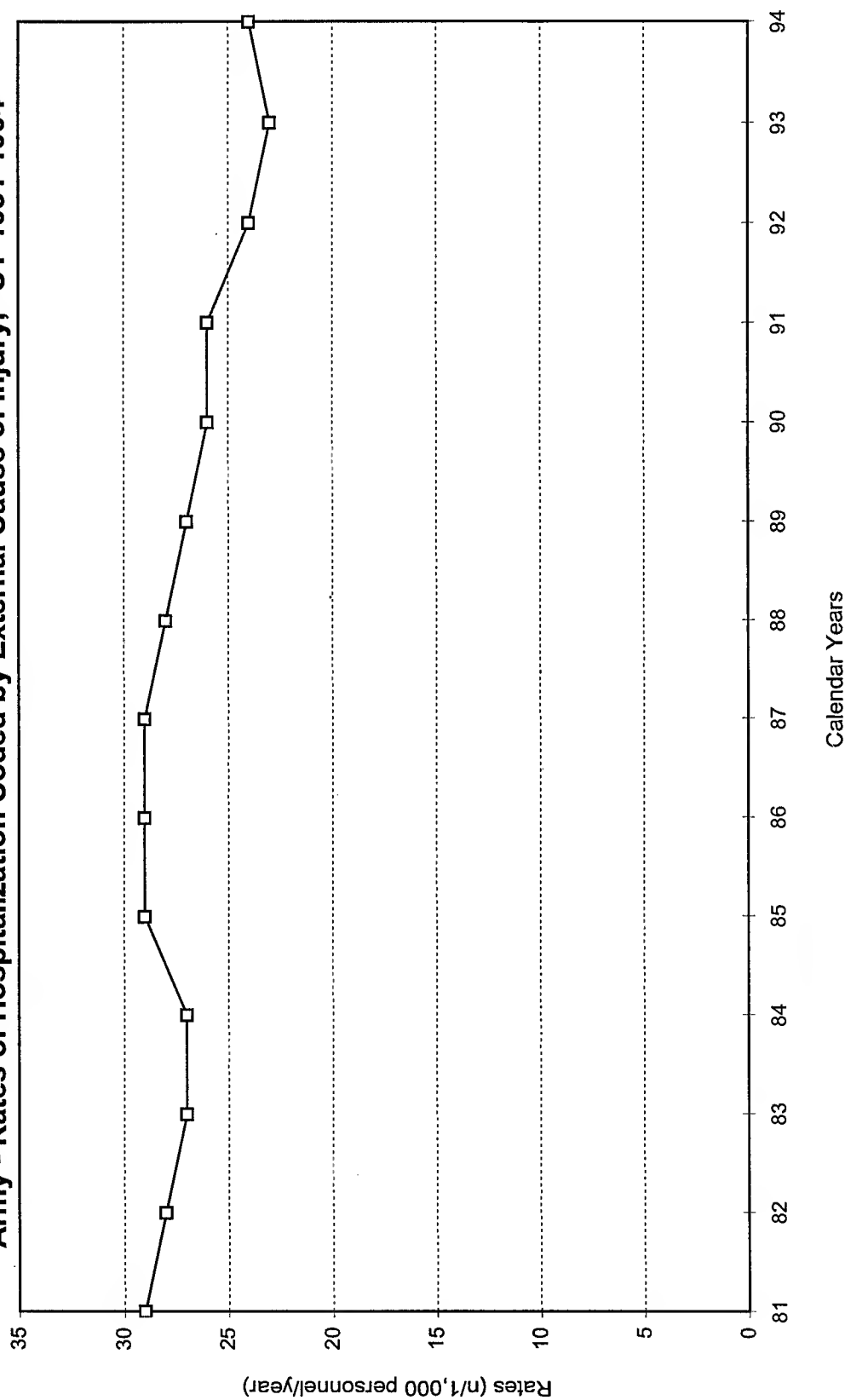
Figure 5-11 illustrates the rates of hospitalization coded by external cause of injury for active duty Army personnel for CY 1981-1994. The overall rate decreased 17% from 29 per 1,000 personnel in CY 1981 to 24 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-11

Army - Rates of Hospitalizations by External Cause of Injury by Calendar Year*													
1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
29	28	27	27	29	29	29	28	27	26	26	24	23	24

* Rates per 1,000 personnel.

Army - Rates of Hospitalization Coded by External Cause of Injury,* CY 1981-1994



* NATO Standard Agreement (STANAG) codes.

Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-11

Figure 5-12 illustrates the rates of hospitalization for the top 10 external causes of injury for active duty Army personnel for CY 1981-1994.

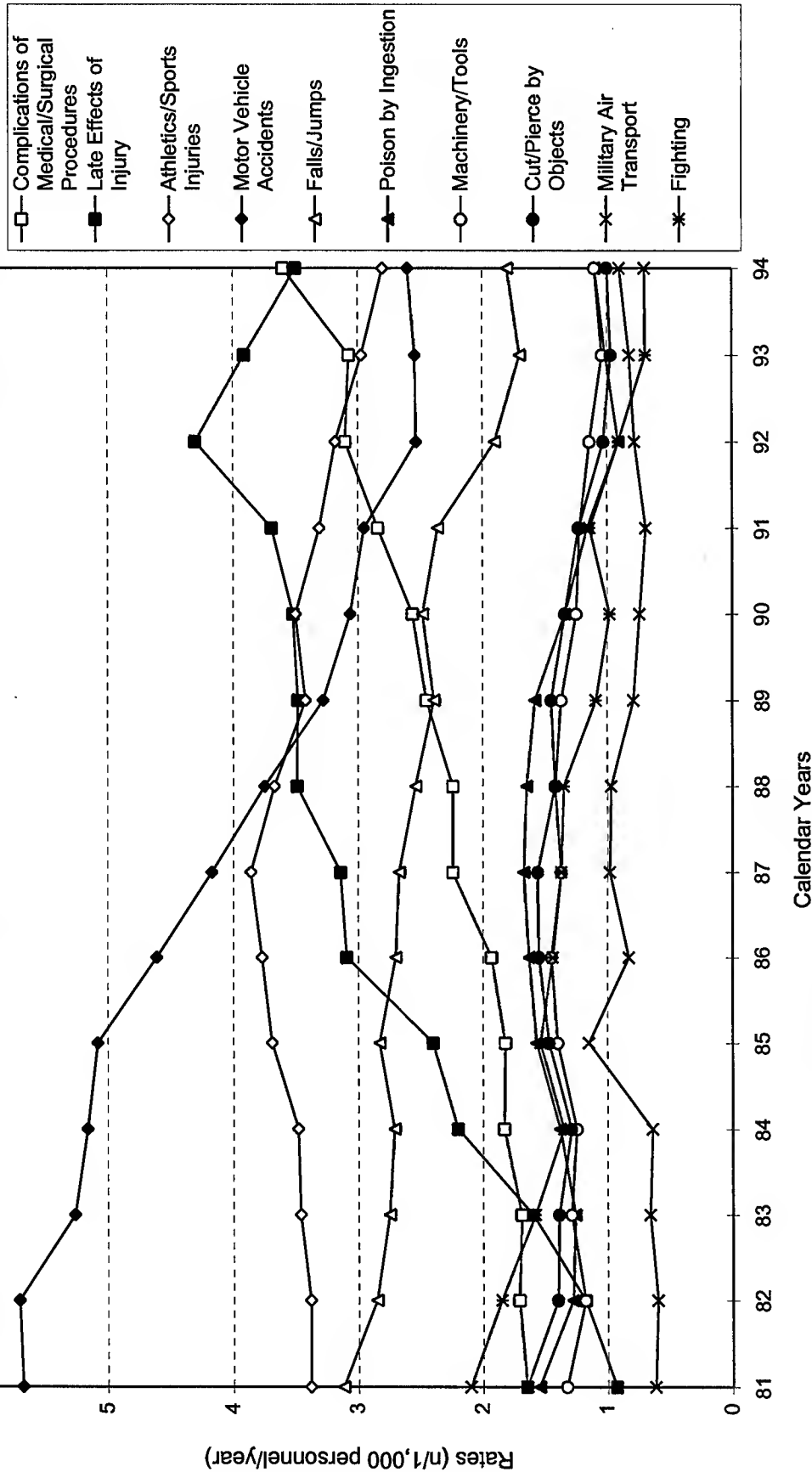
- Complications of medical or surgical procedures rates increased 118% from 1.65 per 1,000 personnel in CY 1981 to 3.60 per 1,000 personnel in CY 1994.
- Late effects of injury rates increased 276% from 0.93 per 1,000 personnel in CY 1981 to 3.50 per 1,000 personnel in CY 1994.
- Athletics and sports injuries rates decreased 17% from 3.38 per 1,000 personnel in CY 1981 to 2.80 per 1,000 personnel in CY 1994.
- Motor vehicle accident rates decreased 54% from 5.67 per 1,000 personnel in CY 1981 to 2.60 per 1,000 personnel in CY 1994.
- Falls and jumps rates decreased 42% from 3.12 per 1,000 personnel in CY 1981 to 1.80 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-12

Army - Rates of Injury Hospitalization by Calendar Year*														
Top 10 External Causes (Rank Based on 1994 Data)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	1.65	1.71	1.69	1.83	1.82	1.93	2.24	2.24	2.45	2.56	2.84	3.10	3.07	3.60
Complications of Medical/Surgical Procedures														
Late Effects of Injury	0.93	1.18	1.60	2.20	2.40	3.09	3.14	3.49	3.48	3.52	3.69	4.30	3.91	3.50
Athletics/Sports Injuries	3.38	3.38	3.46	3.48	3.69	3.77	3.86	3.67	3.42	3.50	3.31	3.18	2.97	2.80
Motor Vehicle Accidents	5.67	5.70	5.26	5.16	5.08	4.61	4.17	3.75	3.28	3.06	2.95	2.53	2.54	2.60
Falls/Jumps	3.12	2.85	2.75	2.71	2.83	2.70	2.67	2.54	2.39	2.48	2.36	1.90	1.70	1.80
Poisoning by Ingestion	1.55	1.28	1.26	1.38	1.57	1.63	1.67	1.65	1.58	1.34	1.16	0.91	1.01	1.10
Machinery/Tools	1.33	1.18	1.29	1.25	1.40	1.45	1.37	1.42	1.37	1.25	1.22	1.14	1.04	1.10
Cut/Pierce by Objects	1.65	1.40	1.39	1.29	1.47	1.55	1.56	1.42	1.45	1.34	1.23	1.03	0.97	1.00
Military Air Transport Accidents	0.62	0.60	0.66	0.64	1.15	0.83	0.98	0.97	0.79	0.74	0.69	0.78	0.82	0.90
Fighting	2.10	1.85	1.58	1.35	1.54	1.44	1.37	1.35	1.09	0.98	1.14	0.91	0.69	0.70

* Rates per 1,000 personnel.

Army - Rates of Hospitalization for the Top 10 External Causes of Injury,* CY 1981-1994



* NATO Standard Agreement (STANAG) codes.

Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-12

Figure 5-13 illustrates the NERs for hospitalizations for the top 10 external causes of injury for active duty Army personnel for CY 1981-1994.

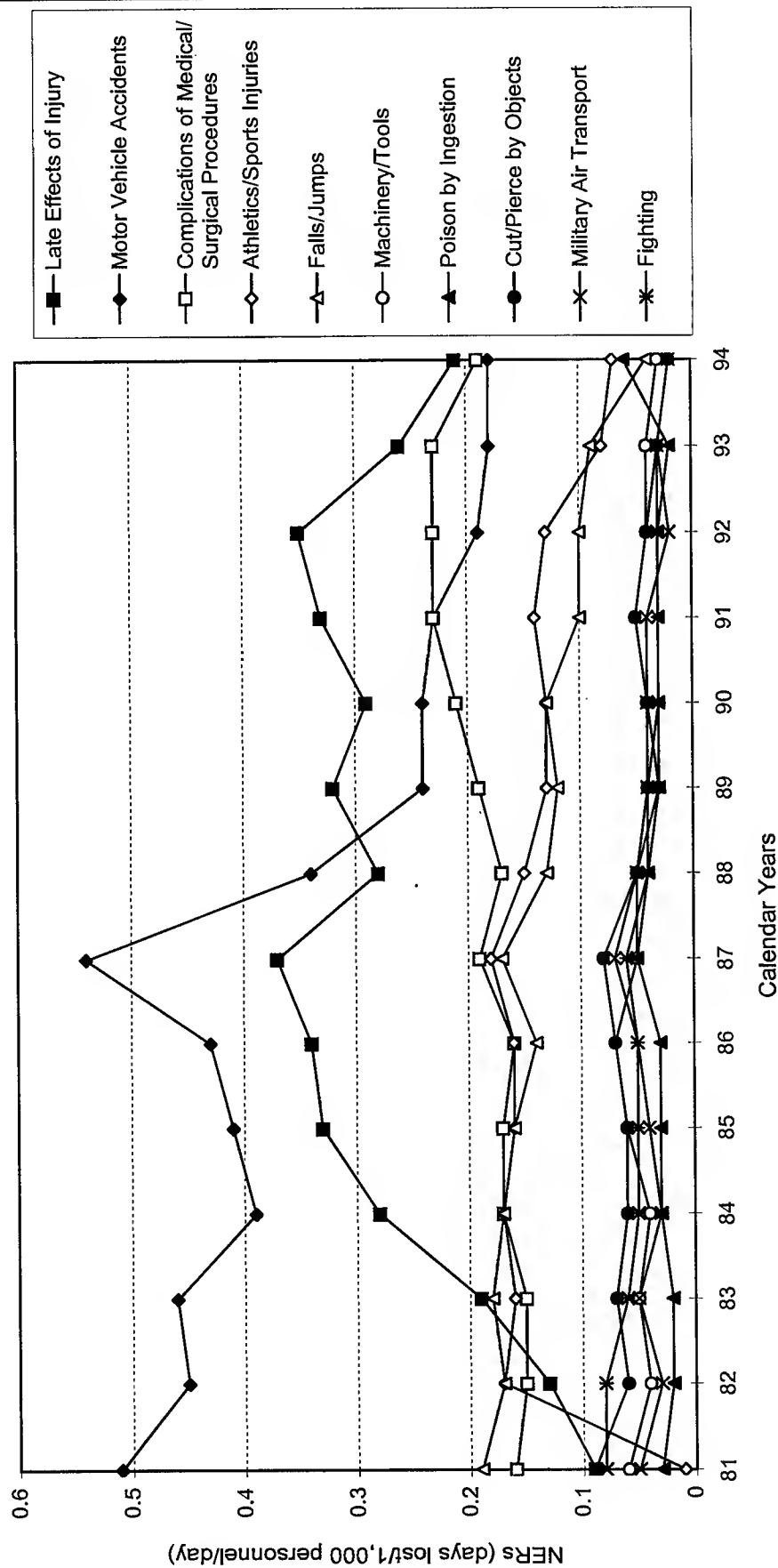
- Late effects of injury NERs increased 133% from 0.09 per 1,000 personnel in CY 1981 to 0.21 per 1,000 personnel in CY 1994.
- Motor vehicle accident NERs decreased 64% from 0.51 per 1,000 personnel in CY 1981 to 0.18 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-13

Top 10 External Causes (Rank Based on 1994 Data)	Army - NERs for Hospitalizations Due to Injuries by Calendar Year*													
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Late Effects of Injury	0.09	0.13	0.19	0.28	0.33	0.34	0.37	0.28	0.32	0.29	0.33	0.35	0.26	0.21
Complications of Medical/Surgical Procedures	0.16	0.15	0.15	0.17	0.17	0.16	0.19	0.17	0.19	0.21	0.23	0.23	0.23	0.19
Motor Vehicle Accidents	0.51	0.45	0.46	0.39	0.41	0.43	0.54	0.34	0.24	0.24	0.23	0.19	0.18	0.18
Athletics/Sports Injuries	0.01	0.17	0.16	0.17	0.16	0.16	0.18	0.15	0.13	0.13	0.14	0.13	0.08	0.07
Falls/Jumps	0.19	0.17	0.18	0.17	0.16	0.14	0.17	0.13	0.12	0.13	0.10	0.10	0.09	0.06
Machinery/Tools	0.06	0.04	0.05	0.04	0.06	0.07	0.05	0.05	0.03	0.04	0.05	0.04	0.04	0.03
Poisoning by Ingestion	0.03	0.02	0.02	0.03	0.03	0.03	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.03
Cut/Pierce by Object	0.09	0.06	0.07	0.06	0.06	0.07	0.08	0.05	0.04	0.04	0.05	0.04	0.03	0.02
Military Air Transport Accidents	0.05	0.03	0.05	0.03	0.04	0.05	0.07	0.05	0.03	0.04	0.04	0.02	0.03	0.02
Fighting	0.08	0.08	0.06	0.05	0.05	0.05	0.06	0.04	0.04	0.03	0.03	0.03	0.03	0.02

* Rates are days lost per 1,000 personnel per day.

Army - Non-Effective Rates for Hospitalization for the Top 10 External Causes of Injury,* CY 1981-1994



*NATO Standard Agreement (STANAG) codes.

Source: Individual Patient Data Systems, Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, TX, and the Army Medical Surveillance Activity, USACHPPM, 1994.

Figure 5-13

Table 5-6 displays the frequency, case rate, and NER data by external cause of injury for hospitalized active duty Army men and women for CY 1994.

- The top three hospitalization rates for men were:
 - Late effects of injury—3.64.
 - Athletics and sports injuries—3.11.
 - Complications of medical or surgical procedures—2.99.
- The top three hospitalization rates for women were:
 - Complications of medical or surgical procedures—7.33.
 - Motor vehicle accidents—2.62.
 - Late effects of injury—2.35.
- The top three NERs for men were:
 - Late effects of injury—82.07.
 - Motor vehicle accidents—69.03.
 - Complications of medical or surgical procedures—63.48.
- The top three NERs for women were:
 - Complications of medical or surgical procedures—98.94.
 - Late effects of injury—45.73.
 - Motor vehicle accidents—40.44.
- Late effects of injury and complications of medical or surgical procedures were among the top three hospitalization case rates and NERs for both men and women.
- Men and women had similar case rates of motor vehicle accidents.
- Men had nearly three times the rate of sports injuries as compared to women.

Table 5-6. Army - Frequency (n), Case Rates, and Non-Effective Rates by External Cause of Injury for Hospitalized Active Duty Men and Women, CY 1994

External Causes of Injury	Men			Women			Total		
	n	Case Rate*	NER†	n	Case Rate	NER	n	Case Rate	NER
Late Effects of Injury	1,745	3.64	82.07	166	2.35	45.73	1,911	3.47	77.42
Athletics/Sports Injuries	1,490	3.11	28.55	77	1.09	5.06	1,567	2.85	25.54
Complications of Medical/Surgical Procedures	1,436	2.99	63.48	517	7.33	98.94	1,953	3.55	68.02
Motor Vehicle Accidents	1,235	2.58	69.03	185	2.62	40.44	1,420	2.58	65.37
Falls/Jumps	837	1.75	20.90	161	2.28	18.90	998	1.81	20.64
Unknown or Unspecified Agents	729	1.52	14.04	110	1.56	12.42	839	1.53	13.83
Machinery/Tools	580	1.21	9.62	45	0.64	6.20	625	1.14	9.19
Cut/Pierce by Objects	504	1.05	7.71	62	0.88	11.97	566	1.03	8.25
Military Air Transport Accidents	477	1.00	7.95	15	0.21	1.25	492	0.89	7.09
Poisoning by Ingestion	437	0.91	8.48	165	2.34	17.90	602	1.09	9.69
Fighting	366	0.76	7.37	29	0.41	9.15	395	0.72	7.59
Poisoning by Inhalation, Fire, or Corrosive Agents	338	0.71	8.80	50	0.71	5.50	388	0.71	8.38
Guns, Explosives, and Related Agents	248	0.52	12.50	11	0.16	3.40	259	0.47	11.33
Twisting/Turning/Slipping	241	0.50	6.57	32	0.45	13.22	273	0.50	7.43
Excessive Heat	173	0.36	0.91	23	0.33	0.94	196	0.36	0.91

Table 5-6.—Continued

External Causes of Injury	Men			Women			Total		
	n	Case Rate*	NER†	n	Case Rate	NER	n	Case Rate	NER
Other Specified Environmental Factors	126	0.26	0.89	12	0.17	0.45	138	0.25	0.84
Water and Other Land Transport	100	0.21	3.65	9	0.13	1.59	109	0.20	3.38
Lifting/Pushing/Pulling	69	0.14	1.08	11	0.17	0.71	80	0.15	1.03
Marching/Drilling	49	0.10	1.10	11	0.16	2.51	60	0.11	1.28
Complications of Prophylactic Inoculations	33	0.07	0.13	11	0.16	0.30	44	0.08	0.15
Excessive Cold	27	0.06	0.52	14	0.20	0.64	41	0.08	0.53
Nonmilitary Air Transport Accidents	12	0.03	0.08	1	0.01	0.10	13	0.02	0.08
Hanging/Suffocation	11	0.02	0.19	1	0.01	0.06	12	0.02	0.18
Conventional Weapons Injury	9	0.02	2.20	0	0	0	9	0.02	1.92
Drowning or Submersion	7	0.02	0.01	0	0	0	7	0.01	0.01
Accidents with Own Instruments of War	3	0.01	0.54	0	0	0	3	0.01	0.47
Escape System Injuries	2	0	0.10	0	0	0	2	0	0.09
Totals	11,284	23.55	358.47	1,718	24.37	297.38	13,002	23.65	350.64

* Case Rate = number of persons hospitalized per 1,000 personnel per year.

† NER = number of persons on the hospital rolls per 1,000 personnel per year.

Source: Army Medical Surveillance Activity, USACHPPM, 1996.

5-7. Navy

The Navy has two sources of hospitalization data:

- For reporting purposes, the NMIMC, whose data is cited in this section, groups hospitalization data using major diagnostic categories (MDC) instead of the standard ICD-9 principal diagnostic groups (PDG) used elsewhere in this chapter. The MDC system groups diagnoses based on diagnosis related groups (DRG) and is comprised of 25 categories (see Appendix A, Table A-4).
- In contrast, NHRC, which supplied data that overlaps several years of the NMIMC data, reported hospitalization data using the same ICD-9 PDGs presented elsewhere by the Army and Air Force. The ICD system is comprised of 18 major subgroups. NHRC data is provided in Supplement B for comparison purposes.

The Navy hospitalization data are presented in three parts:

- The Navy Summary. The Navy hospitalization data presented in this section are summarized in three tables.
 - The overall summary is presented in Table 5-7.
 - The data in figures 5-15 and 5-16 are summarized in Table 5-8.
 - The data in figures 5-18, 5-19, and 5-20 are summarized in Table 5-9.
- Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.
 - The distribution of hospitalizations by major diagnostic categories for FY 1994 is displayed in Figure 5-14.
 - The distribution of the top 15 musculoskeletal system diagnoses for hospitalized men and women for FY 1994 are displayed in figures 5-15 and 5-16, respectively.
- Trends of Navy Injury-Related Hospitalizations Over Time.
 - The rates of hospitalization by year for FY 1989-1994 are displayed in Figure 5-17.
 - The rates of the top 10 causes of hospitalization for all personnel, men, and women for FY 1989-1994 are displayed in figures 5-18, 5-19, and 5-20, respectively.
 - The rates of hospitalization for musculoskeletal system diagnoses for men and women for FY 1989-1994 are displayed in Figure 5-21.
 - The frequency and case rates by major diagnostic categories for hospitalized men and women for FY 1994 are presented in Table 5-10.

The Navy Summary.

Table 5-7. Overall Summary of Hospitalization Data for Active Duty Navy Personnel

Year	Navy Population	Hospitalizations		Rates and Trends of Hospitalizations		Conclusion
		Total	n/1,000 Personnel /Year	n/1,000 Personnel /Year	Trend, % Change (FY 1989-1994)	
FY89-94 FY94	— 468,662	— 32,021	— 71	93 (FY89) —	71 (FY94) —	Navy hospitalization rates have declined over this 6-year period.

Table 5-8. Summary of Hospitalizations by the Top 15 Musculoskeletal System Diagnoses for Active Duty Navy Men and Women, FY 1994

Top 15 Musculoskeletal System Diagnoses	Distribution (%) of Total Hospitalizations				Conclusion
	Men (n = 6,241)		Women (n = 886)		
	%	Rank	%	Rank	
Internal Derangement of the Knee	10.8%	1	5.3%	4	Most of the musculoskeletal system diagnoses for both men and women appear to be injury related.
Old Injuries, Anterior Cruciate Ligament	9.3%	2	6.2%	3	
Lumbar Disc Displacements	4.9%	3	2.1%	10	
Removal of Fracture Plates	4.8%	4	4.9%	5	
Shoulder Joint Derangements	2.8%	5	—	—	
Patella Chondromalacia	2.6%	6	2.4%	7	
Fracture Nonunion	2.3%	7	—	—	
Other Shoulder Conditions	2.1%	8	—	—	
Meniscus/Medial Cart Knee Tears	2.1%	9	—	—	
Recurring Shoulder Dislocations	1.8%	10	—	—	
Joint Ganglion	1.7%	11	3.5%	6	
Cruciate Ligament Sprains Knee	1.7%	12	1.7%	15	
Cervical Disc Displacements	1.5%	13	—	—	
Hallux Valgus	1.4%	14	9.0%	1	
Bunions	1.3%	15	7.8%	2	
Disorder of Synovium/Tendon/Bursa	—	—	2.3%	8	
Hammer Toe Other	—	—	2.3%	9	
Lower Leg Joint Pain	—	—	2.0%	11	
Ganglion, Unspecified	—	—	2.0%	12	
Ankle/Foot Joint Derangements Other	—	—	1.8%	13	
Tendon Sheath Ganglion	—	—	1.7%	14	

Table 5-9. Rates of Top 10 Causes of Hospitalization by Major Diagnostic Category for Active Duty Navy Personnel, FY 1989-1994

Table 5-9. Rates of Top 10 Causes of Hospitalization by Major Diagnostic Category for Active Duty Navy Personnel, FY 1989-1994										
Rates Per 1,000 Personnel/Year										Conclusions
Top 10 Causes of Hospitalization	Total			Men			Women			
	FY 1989	FY 1994	% Change (FY 89-94)	FY 1989	FY 1994	% Change (FY 89-94)	FY 1989	FY 1994	% Change (FY 89-94)	
MDC 8: Musculoskeletal System	22	16	Down 24%	22	16	Down 27%	21	17	Down 19%	• Every major diagnostic category in the top 10 decreased (25 to 50%) except pregnancy, which increased 29% and ear/nose/throat and circulatory system, which registered no change. • Musculoskeletal system diseases decreased 24%.
MDC 6: Digestive System	11	9	Down 18%	11	9	Down 18%	14	9	Down 36%	
MDC 19: Mental Disorders	8	6	Down 25%	7	6	Down 14%	13	10	Down 23%	
MDC 14: Pregnancy	7	9	Up 29%	—	—	—	75	76	Up 1%	
MDC 3: Ear, Nose, Mouth, & Throat	6	6	No change	6	5	Down 17%	9	8	Down 11%	
MDC 9: Skin & Breast	6	4	Down 33%	5	3	Down 40%	10	9	Down 10%	
MDC 20: Alcohol & Drugs	6	3	Down 50%	6	3	Down 50%	—	2	—	
MDC 5: Circulatory System	3	3	No change	—	—	—	—	2	—	
MDC 1: Nervous System	4	2	Down 50%	3	2	Down 33%	6	4	Down 33%	
MDC 12: Male Reproductive System	3	2	Down 33%	2	2	No change	—	—	—	
MDC 13: Female Reproductive System	—	—	—	—	—	—	27	21	Down 22%	
MDC 18: Infectious & Parasitic	—	—	—	5	1	Down 80%	—	—	—	
MDC 4: Respiratory System	—	—	—	2	1	Down 50%	—	—	—	
MDC 21: Injury	—	—	—	—	—	—	3	2	Down 33%	
MDC 10: Endocrine, Nutritional, & Metabolic	—	—	—	—	—	—	2	3	Up 50%	

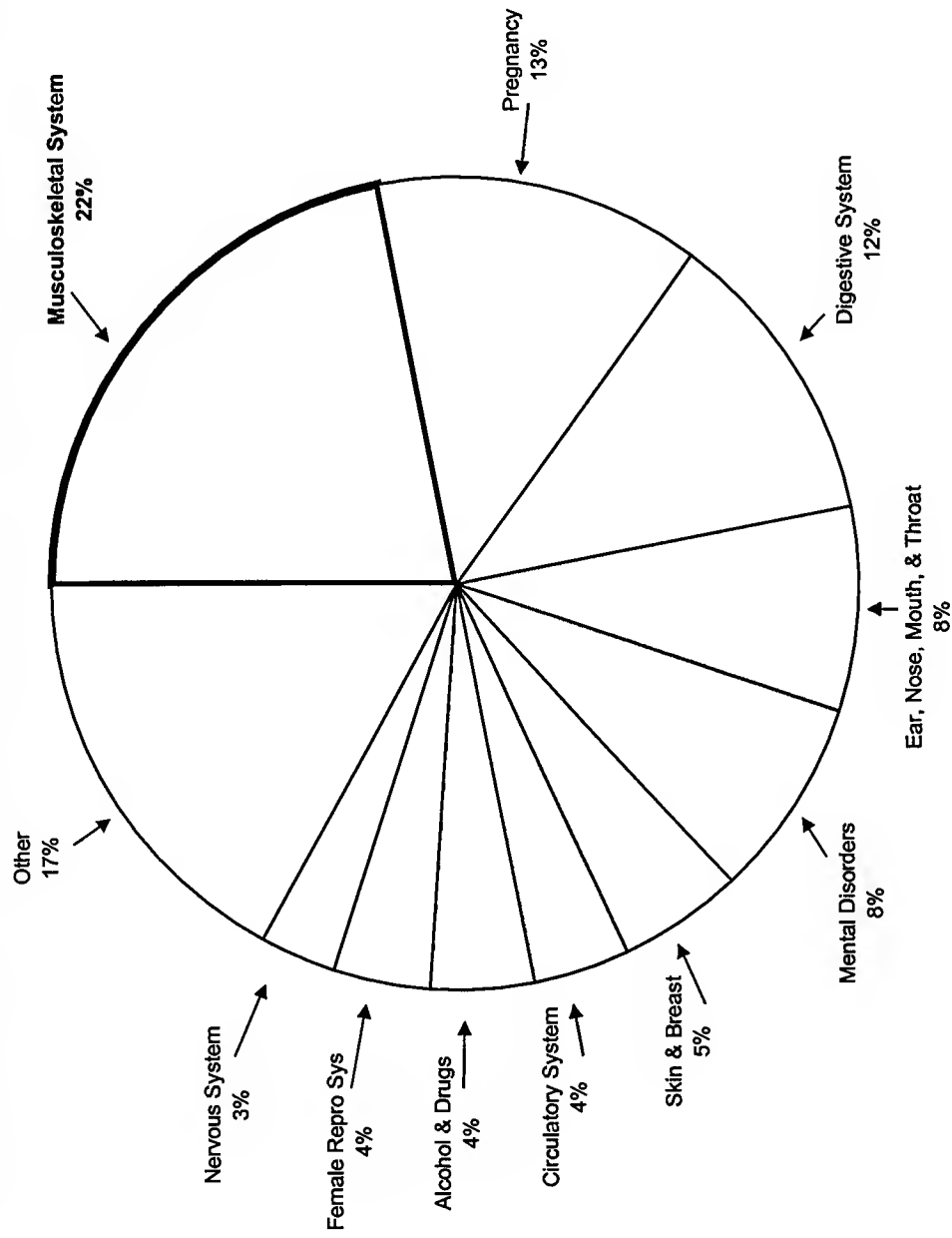
Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.

Figure 5-14 illustrates the distribution of hospitalizations by major diagnostic categories for active duty Navy personnel for FY 1994. Of a total of 32,021 hospitalizations, the top five contributors to hospitalization were:

- Musculoskeletal system (most of which are largely injury related) (MDC 8)—22%.
- Pregnancy (MDC 14)—13%.
- Digestive system (MDC 6)—12%.
- Ear, nose, mouth, and throat (MDC 3)—8%.
- Mental disorders (MDC 19)—8%.

When using MDCs to group hospitalizations of Navy personnel, some hospitalizations coded within the musculoskeletal system group (MDC 8) will actually represent acute injuries. For instance, ligamentous sprains fall into MDC 8, whereas the same injury under the ICD-9 PDG grouping (used here by the Army and Air Force) would fall under the injury PDG.

Navy - Distribution (%) of Hospitalizations by Major Diagnostic Category,* FY 1994



n = 32,021.

* Major diagnostic categories from the DRG Guidebook, 1996.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

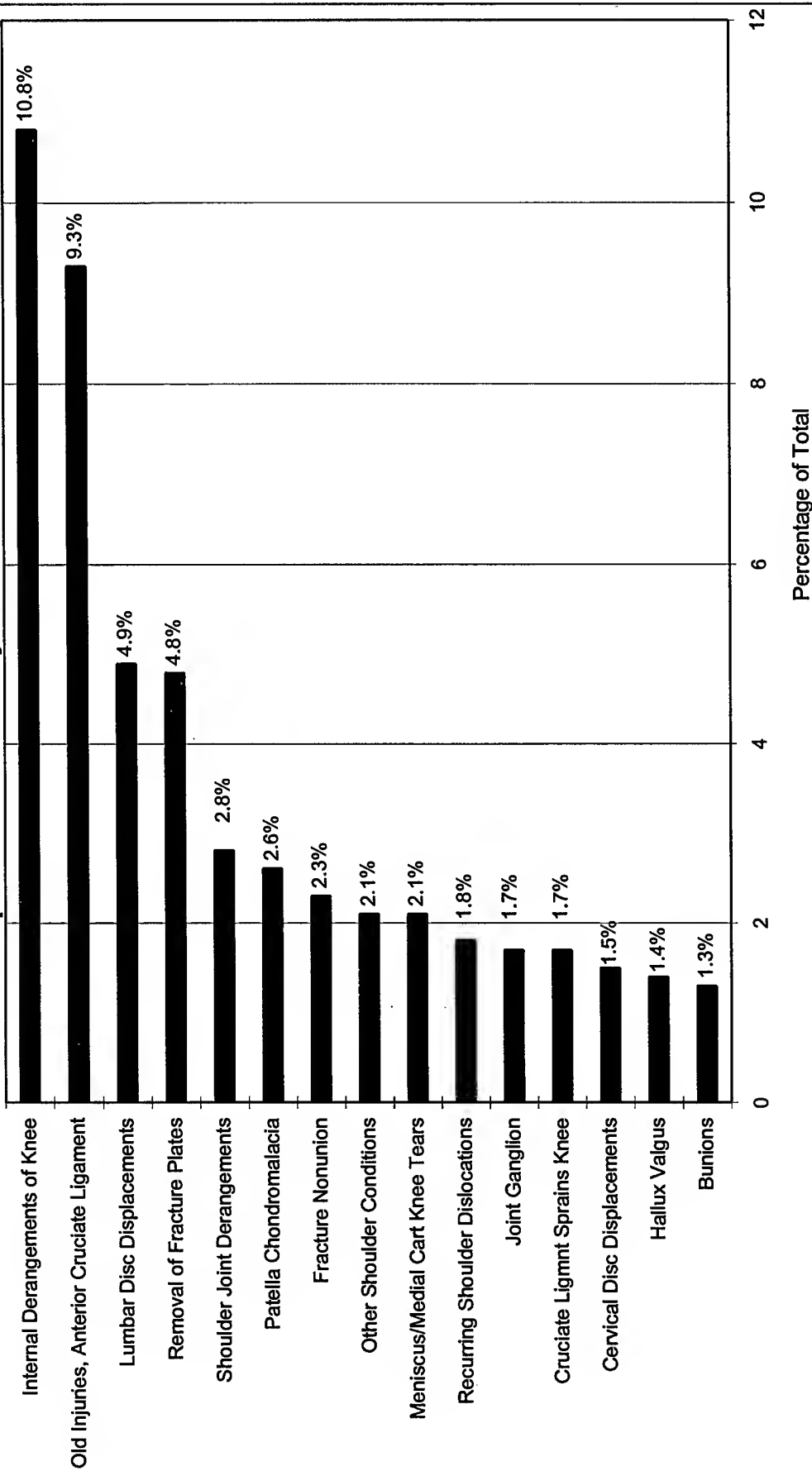
Figure 5-14

Figure 5-15 illustrates the distribution of the top 15 diagnoses in MDC 8 (musculoskeletal system) for hospitalized active duty male Navy personnel for FY 1994. Of a total of 6,241 hospitalizations (see Table 5-8), the top five contributors accounted for 44% of the total:

- Internal derangements of the knee—10.8%.
- Old injuries, anterior cruciate ligament—9.3%.
- Lumbar disc displacements—4.9%.
- Removal of fracture plates—4.8%.
- Shoulder joint derangements—2.8%.

Most of the conditions for men in the musculoskeletal system category appear to be injury related.

Navy - Distribution (%) of Top 15 Musculoskeletal System Diagnoses for Hospitalized Active Duty Men, FY 1994



Total musculoskeletal hospitalizations for men = 6,241.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

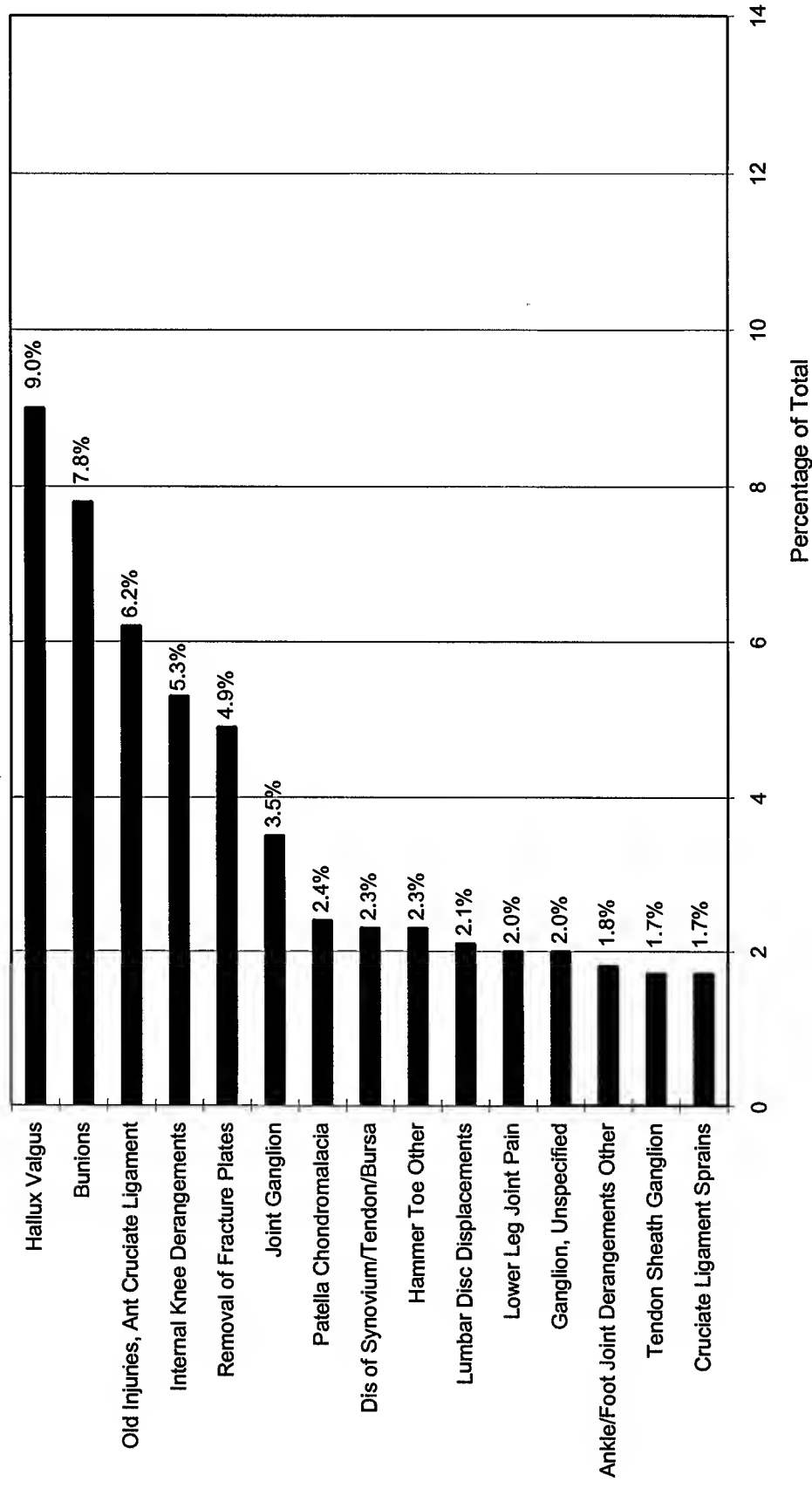
Figure 5-15

Figure 5-16 illustrates the distribution of the top 15 diagnoses in MDC 8 (musculoskeletal system) for hospitalized active duty female Navy personnel for FY 1994. Of a total of 886 hospitalizations (see Table 5-8), the top five contributors accounted for 43% of the total:

- Hallux valgus—9.0%.
- Bunions—7.8%.
- Old injuries, anterior cruciate ligament—6.2%.
- Internal knee derangements—5.3%.
- Removal of fracture plates—4.9%.

Most of the conditions for women, other than hallux valgus and bunions, appear to be injury related.

Navy - Distribution (%) of Top 15 Musculoskeletal System Diagnoses for Hospitalized Active Duty Women, FY 1994



Total musculoskeletal hospitalizations for women = 886.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-16

Trends of Navy Injury-Related Hospitalizations Over Time.

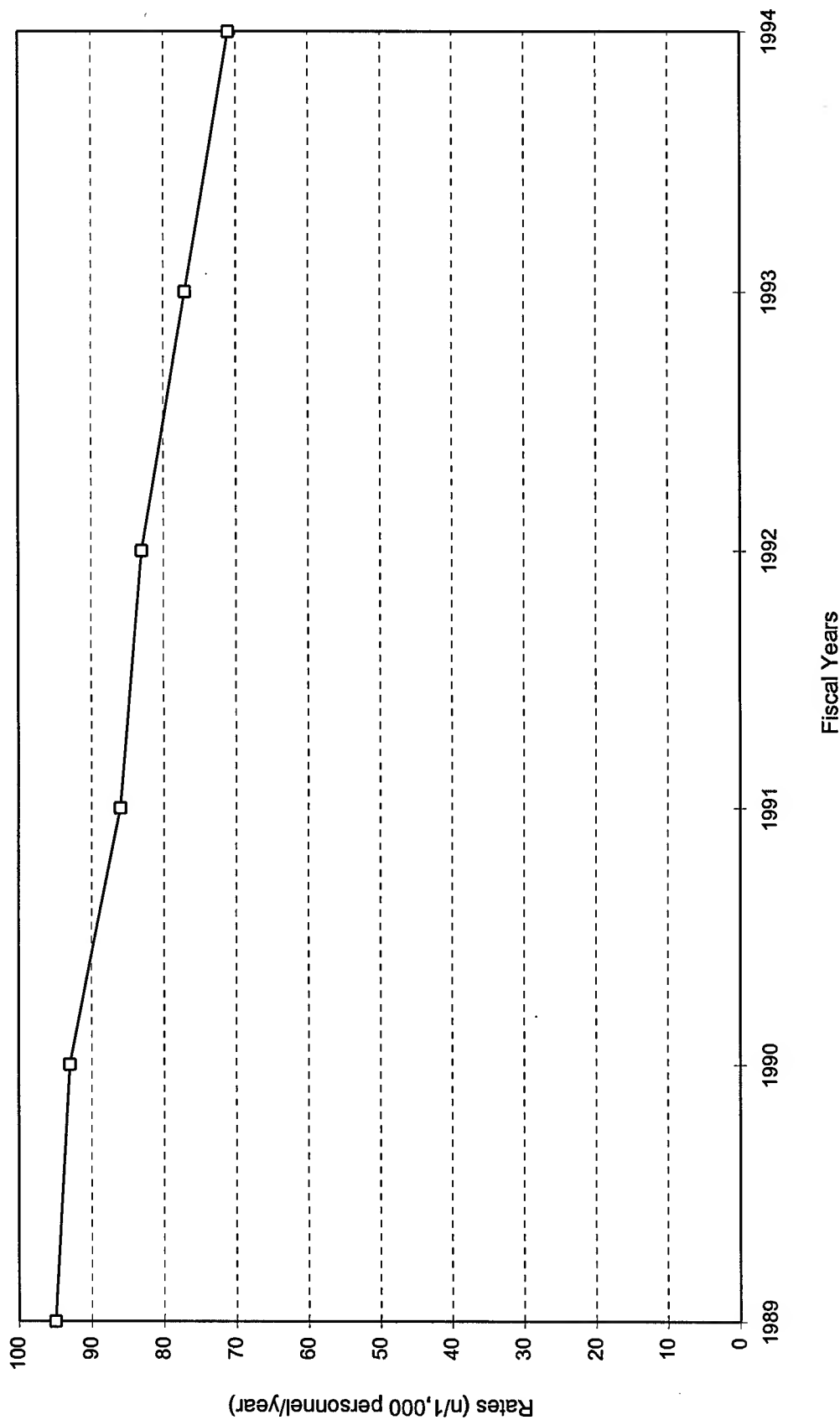
Figure 5-17 illustrates the rates of hospitalization by year for active duty Navy personnel for FY 1989-1994. Hospitalization rates decreased 25% from 95 per 1,000 personnel in FY 1989 to 71 per 1,000 personnel in FY 1994.

Worksheet Data for Figure 5-17

Navy - Rates of Hospitalization by Fiscal Year*				
1989	1990	1991	1992	1994
95	93	86	83	71

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Navy - Rates of Hospitalization by Year, FY 1989-1994



Numerator Source: Naval Medical Information Management Center, Bethesda, MD, 1995.
 Denominator Source (1994): DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIOR/M07-96/01).

Figure 5-17

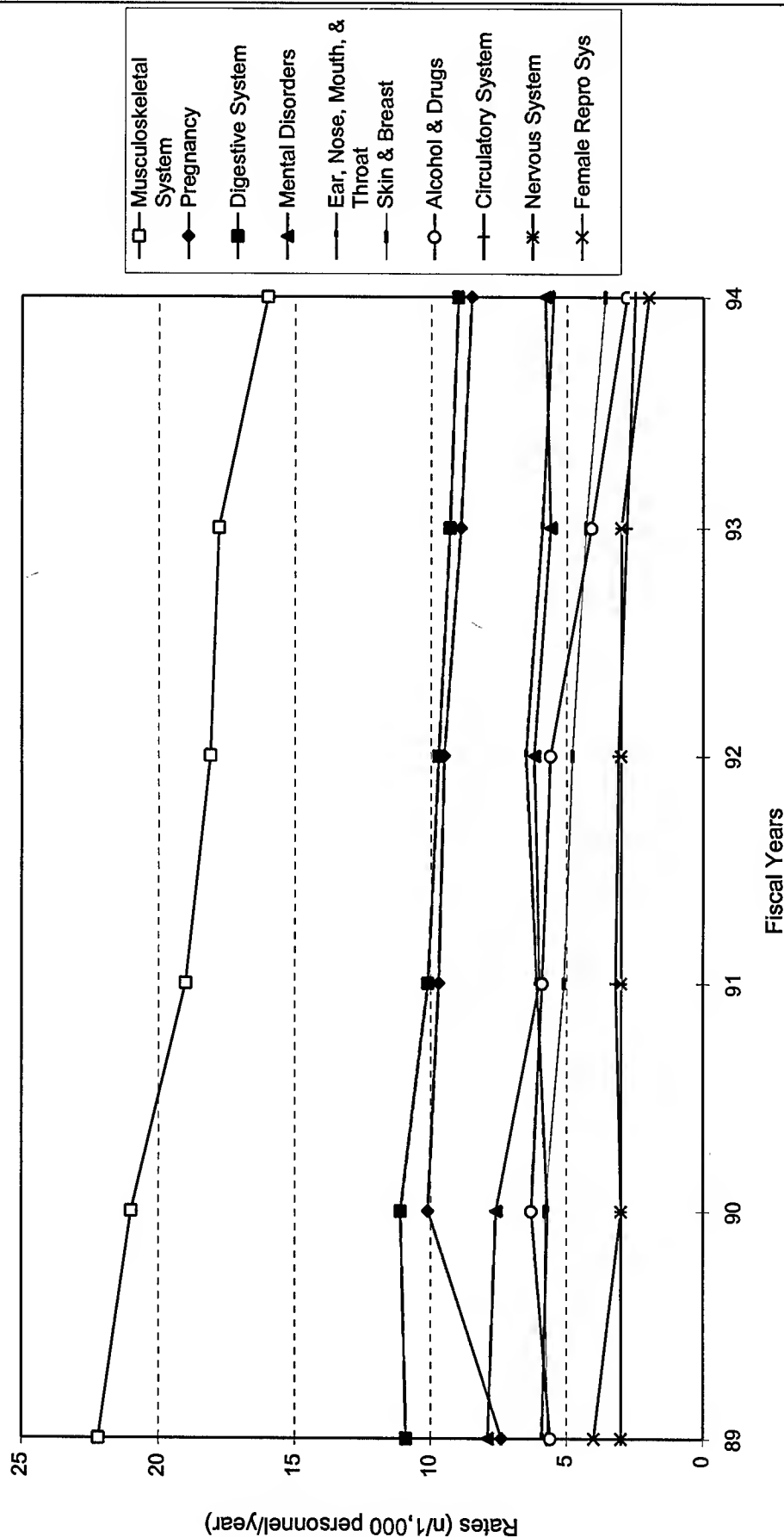
Figure 5-18 illustrates the rates of the top 10 causes of hospitalization by MDC for active duty Navy personnel for FY 1989-1994. Musculoskeletal system diseases decreased 27% from 22 per 1,000 personnel in FY 1989 to 16 per 1,000 personnel in FY 1994.

Worksheet Data for Figure 5-18

Top 10 Causes of Hospitalization by Major Diagnostic Category (Rank Based on 1994 Data)	Navy - Rates of Hospitalization by Fiscal Year*					
	1989	1990	1991	1992	1993	1994
MDC 8: Musculoskeletal System	22	21	19	18	18	16
MDC 14: Pregnancy	7	10	10	10	9	9
MDC 6: Digestive System	11	11	10	10	9	9
MDC 19: Mental Disorders	8	8	6	6	6	6
MDC 3: Ear, Nose, Mouth, & Throat	6	6	6	7	6	6
MDC 9: Skin & Breast	6	6	5	5	4	4
MDC 20: Alcohol & Drugs	6	6	6	6	4	3
MDC 5: Circulatory System	3	3	3	3	3	3
MDC 1: Nervous System	4	3	3	3	3	2
MDC 13: Female Reproductive System	3	3	3	3	3	2

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Navy - Rates of Top 10 Causes of Hospitalization by Major Diagnostic Category,* FY 1989-1994



* Major diagnostic categories from the DRG Guidebook, 1996.

Numerator Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Denominator Source (1994): DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIORM07-96/01).

Figure 5-18

Figure 5-19 illustrates the top 10 causes of hospitalization by MDC for active duty male Navy personnel for FY 1989-1994.

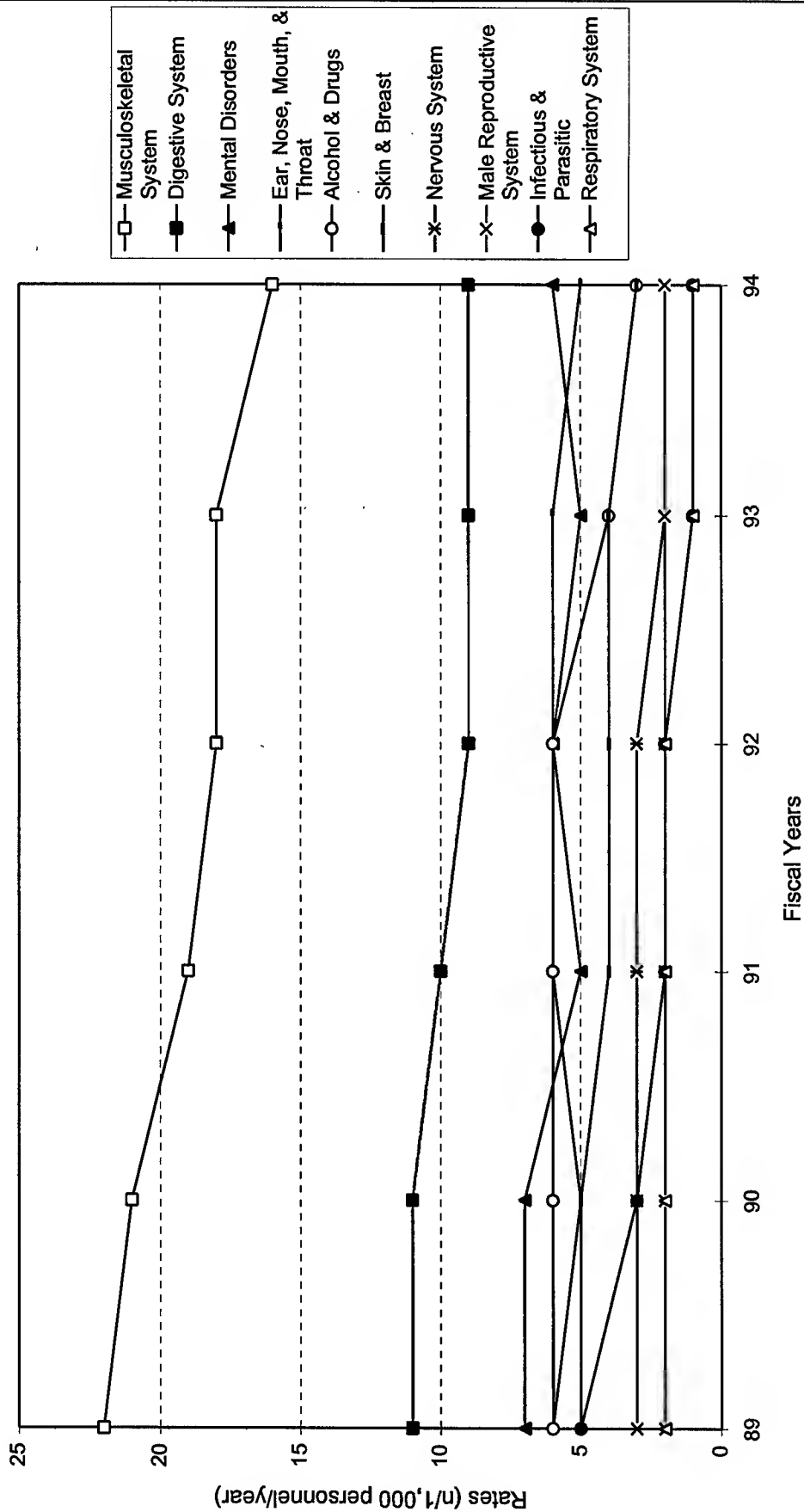
- Hospitalizations due to musculoskeletal system diseases decreased 27% from 22 per 1,000 personnel in FY 1989 to 16 per 1,000 personnel in FY 1994.
- Hospitalizations due to digestive system disorders decreased 18% from 11 per 1,000 personnel in FY 1989 to 9 per 1,000 personnel in FY 1994.
- Hospitalizations for the other causes remained steady over the 6-year period.

Worksheet Data for Figure 5-19

Top 10 Causes of Hospitalization for Men by Major Diagnostic Category (Rank Based on 1994 Data)	Navy - Rates of Hospitalization by Fiscal Year*					
	1989	1990	1991	1992	1993	1994
MDC 8: Musculoskeletal System	22	21	19	18	18	16
MDC 6: Digestive System	11	11	10	9	9	9
MDC 19: Mental Disorders	7	7	5	6	5	6
MDC 3: Ear, Nose, Mouth, & Throat	6	5	6	6	6	5
MDC 20: Alcohol & Drugs	6	6	6	6	4	3
MDC 9: Skin & Breast	5	5	4	4	4	3
MDC 1: Nervous System	3	3	3	3	2	2
MDC 12: Male Reproductive System	2	2	2	2	2	2
MDC 18: Infectious & Parasitic	5	3	2	2	1	1
MDC 4: Respiratory System	2	2	2	2	1	1

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Navy - Rates of Top 10 Causes of Hospitalization for Men by Major Diagnostic Category,* FY 1989-1994



* Major diagnostic categories from the DRG Guidebook, 1996.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-19

Figure 5-20 illustrates the top 10 causes of hospitalization by MDC for active duty female Navy personnel for FY 1989-1994.

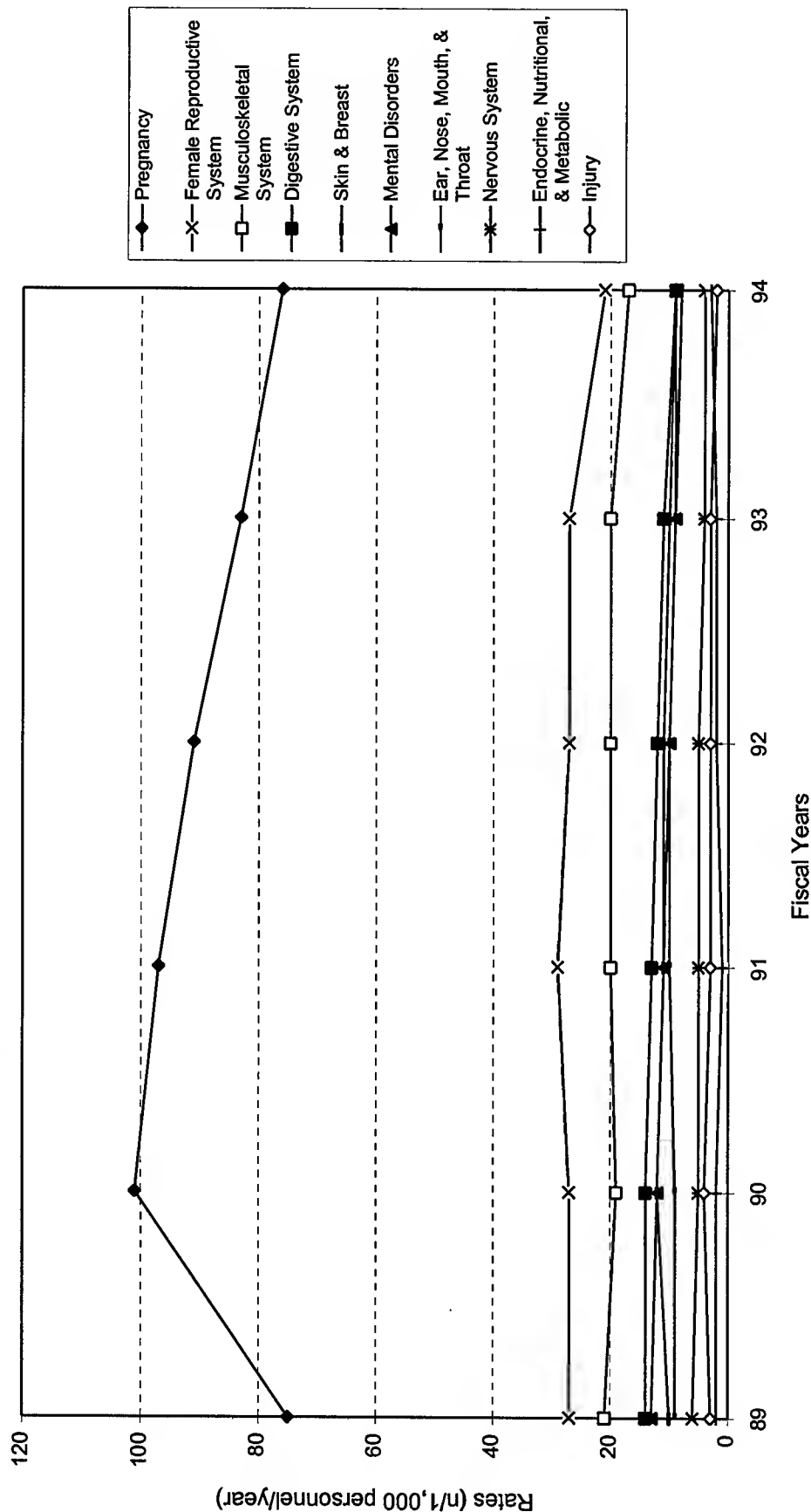
- From FY 1989-1990, there was a notable peak in pregnancies from 75 per 1,000 women to 101 per 1,000 women (up 35%), which subsequently declined in 1994 to the 1989 rate.
- Rates for all other causes declined or remained stable over the 6-year period.
- Musculoskeletal system diseases were the third leading cause of hospitalizations for women in the Navy for the entire period.

Worksheet Data for Figure 5-20

Top 10 Causes of Hospitalization for Women by Major Diagnostic Category (Rank Based on 1994 Data)	Navy - Rates of Hospitalization by Fiscal Year*					
	1989	1990	1991	1992	1993	1994
MDC 14: Pregnancy	75	101	97	91	83	76
MDC 13: Female Reproductive System	27	27	29	27	27	21
MDC 8: Musculoskeletal System	21	19	20	20	20	17
MDC 6: Digestive System	14	14	13	12	11	9
MDC 9: Skin & Breast	10	12	11	11	10	9
MDC 19: Mental Disorders	13	12	11	10	9	9
MDC 3: Ear, Nose, Mouth, & Throat	9	9	10	10	9	8
MDC 1: Nervous System	6	5	5	5	4	4
MDC 10: Endocrine, Nutritional, & Metabolic	2	2	1	2	2	3
MDC 21: Injury	3	4	3	3	3	2

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Navy - Rates of Top 10 Causes of Hospitalization for Women by Major Diagnostic Category,* FY 1989-1994



* Major diagnostic categories from the DRG Guidebook, 1996.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-20

Figure 5-21 illustrates the rates of hospitalization for musculoskeletal system diagnoses for active duty Navy men and women for FY 1989-1994.

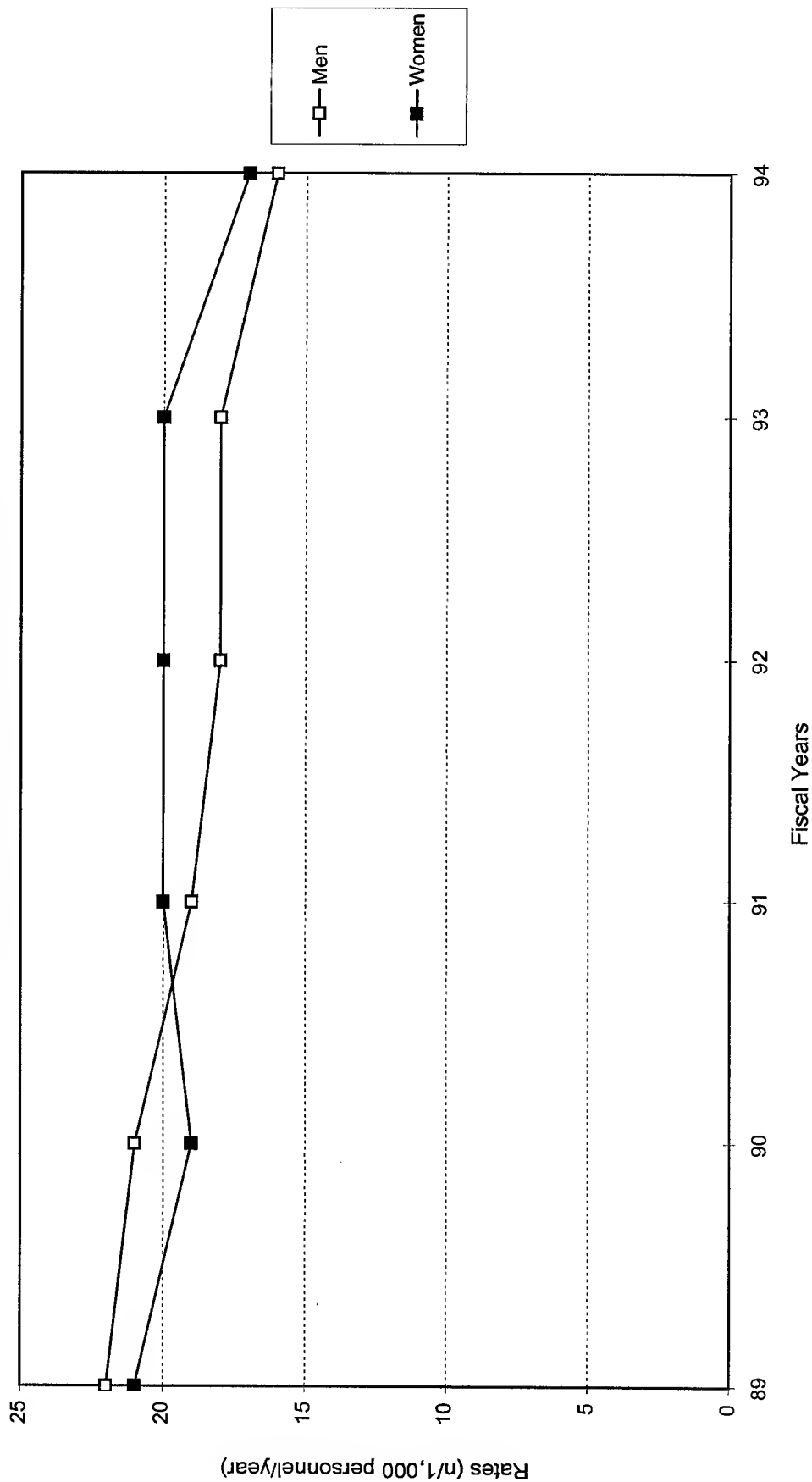
- Musculoskeletal system condition rates for men decreased 27% from 22 per 1,000 personnel in FY 1989 to 16 per 1,000 personnel in FY 1994.
- Musculoskeletal system condition rates for women decreased 19% from 21 per 1,000 personnel in FY 1989 to 17 per 1,000 personnel in FY 1994.

Worksheet Data for Figure 5-21

Musculoskeletal System Diagnoses	Navy - Rates of Hospitalization by Fiscal Year*				
	1989	1990	1991	1992	1994
Men	22	21	19	18	16
Women	21	19	20	20	17

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Navy - Rates of Hospitalization for Musculoskeletal System Diagnoses for Men and Women, FY 1989-1994



Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-21

Table 5-10 displays the frequency and case rates by major diagnostic categories for hospitalized active duty Navy men and women for FY 1994.

- The top three hospitalization rates for men in 1994 were:
 - Musculoskeletal system (MDC 8)—15.6.
 - Digestive system (MDC 6)—8.6.
 - Mental disorders (MDC 19)—5.5.
- The top three hospitalization rates for women in 1994 were:
 - Pregnancy and childbirth (MDC 14)—76.4.
 - Female reproductive system (MDC 13)—21.5.
 - Musculoskeletal system (MDC 8)—16.9.
- Musculoskeletal system diseases were one of the top three contributors to hospitalization case rates for both men and women.
- Navy men and women had similar rates of musculoskeletal system diseases.

Table 5-10. Navy - Frequency (n) and Case Rates by Major Diagnostic Category for Hospitalized Active Duty Men and Women, FY 1994

Major Diagnostic Categories	Men		Women		Total	
	n	Case Rate*	n	Case Rate	n	Case Rate
MDC 8: Musculoskeletal System	6,241	15.6	886	16.9	7,127	15.7
MDC 6: Digestive System	3,446	8.6	492	9.4	3,938	8.7
MDC 19: Mental Disorders	2,209	5.5	495	9.5	2,704	6.0
MDC 3: Ear, Nose, Mouth, & Throat	2,117	5.3	440	8.4	2,557	5.6
MDC 9: Skin & Breast	1,201	3.0	476	9.1	1,677	3.7
MDC 20: Alcohol & Drugs	1,195	3.0	106	2.0	1,301	2.9
MDC 5: Circulatory System	1,077	2.7	106	2.0	1,183	2.6

Table 5-10.—Continued

Major Diagnostic Categories	Men		Women		Total	
	n	Case Rate*	n	Case Rate	n	Case Rate
MDC 12: Male Reproductive System	828	2.1	0	0.0	828	1.8
MDC 1: Nervous System	720	1.8	211	4.0	931	2.1
MDC 4: Respiratory System	559	1.4	81	1.5	640	1.4
MDC 21: Injury	533	1.3	109	2.1	642	1.4
MDC 11: Kidney & Urinary	486	1.2	103	2.0	589	1.3
Ungroupable	438	1.01	89	1.7	527	1.2
MDC 18: Infectious & Parasitic	363	0.9	55	1.01	418	0.9
MDC 2: Eye	360	0.9	46	0.9	406	0.9
MDC 7: Liver & Pancreas	297	0.7	86	1.6	383	0.8
MDC 23: Health Status	231	0.6	47	0.9	278	0.6
MDC 10: Endocrine, Nutritional, & Metabolic	203	0.5	151	2.9	354	0.8
MDC 17: Neoplasms	175	0.4	32	0.6	207	0.5
MDC 16: Blood & Immunology	142	0.4	25	0.5	167	0.4
MDC 22: Burns	35	0.1	1	0.0	36	0.1
MDC 13: Female Reproductive System	0	0.0	1125	21.5	1125	2.5
MDC 14: Pregnancy	0	0.0	4003	76.4	4003	8.8
Totals	22856	57.0	9165	174.9	32021	3.9

* Case rate = number of persons hospitalized per 1,000 personnel per year.

Source: Naval Medical Information Management Center, Bethesda, MD, 1996. Rates calculated using population data in Table 1-8.

5-8. Marine Corps

The Marine Corps hospitalization data are presented in three parts:

- The Marine Corps Summary. The Marine Corps hospitalization data presented in this section are summarized in three tables.
 - The overall summary is presented in Table 5-11.
 - The data in figures 5-23 and 5-24 are presented in Table 5-12.
 - The data in figures 5-26, 5-27, and 5-28 are summarized in Table 5-13.
- Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.
 - The distribution of hospitalizations by major diagnostic categories for FY 1994 is displayed in Figure 5-22.
 - The distribution of the top 15 musculoskeletal system diagnoses for hospitalized men and women for FY 1994 is displayed in figures 5-23 and 5-24, respectively.
- Trends of Marine Corps Total Hospitalizations Over Time.
 - The rates of hospitalization by year for FY 1989-1994 are displayed in Figure 5-25.
 - The rates of the top 10 causes of hospitalization for all personnel, men, and women by year for FY 1989-1994 are displayed in figures 5-26, 5-27, and 5-28, respectively.
 - The rates of hospitalization for musculoskeletal system diagnoses for men and women for FY 1989-1994 are displayed in Figure 5-29.
 - The frequency and case rates by major diagnostic categories for hospitalized men and women for FY 1994 is presented in Table 5-14.

The Marine Corps Summary.

Table 5-11. Overall Summary of Hospitalization Data for Active Duty Marine Corps Personnel

Year	Marine Corps Population	Hospitalizations		Rates and Trends of Hospitalizations		Conclusion
		Total	n/1,000 Personnel /Year	n/1,000 Personnel /Year	Trend, % Change (CY 1989-1994)	
FY89-94 FY94	— 174,639	— 10,992	— 61	83 (FY89) —	61 (FY94) —	Hospitalization rates among Marines decreased over the 6-year period, FY 1989-1994.

Table 5-12. Summary of Hospitalizations by the Top 15 Musculoskeletal System Diagnoses for Active Duty Marine Corps Men and Women, FY 1994

Top 15 Musculoskeletal System Diagnoses		Distribution (%) of Hospitalizations				Conclusion
		Men (n = 3,010)		Women (n = 181)		
		%	Rank	%	Rank	
Internal Derangement of the Knee		10.8%	1	5.0%	4	Many of the musculoskeletal system diagnoses appear to be injury related.
Old Injuries, Anterior Cruciate Ligament		9.7%	2	3.9%	—	
Removal of Fracture Plates		4.8%	3	6.6%	2	
Shoulder Joint Derangements		4.0%	4	—	—	
Lumbar Disc Displacements		3.7%	5	1.7%	—	
Fracture Nonunion		2.8%	—	2.2%	—	
Patella Chondromalacia		2.8%	—	3.3%	—	
Bunions		2.5%	—	11.0%	1	
Lower Leg Joint Derangements		2.0%	—	1.7%	—	
Recurring Shoulder Dislocations		1.9%	—	—	—	
Lower Leg Joint Pain		1.7%	—	2.8%	—	
Other Dis/Cond of Shoulder		1.6%	—	—	—	
Hallux Valgus		1.6%	—	6.1%	3	
Closed Ankle Fractures, Unspecified		1.5%	—	—	—	
Ankle/Foot Joint Derangements Other		1.3%	—	2.2%	—	
Joint Ganglion		—	—	1.7%	—	
Lumbago		—	—	2.2%	—	
Hammer Toe Other		—	—	4.4%	5	
Tendon Sheath Ganglion		—	—	1.7%	—	

Table 5-13. Rates of Top 10 Causes of Hospitalization for Active Duty Marine Corps Personnel, FY 1989-1994

Top 10 Causes of Hospitalization	Rates Per 1,000 Personnel/Year										Conclusions
	Total			Men			Women				
	FY 1989	FY 1994	% Change (FY 89-94)	FY 1989	FY 1994	% Change (FY 89-94)	FY 1989	FY 1994	% Change (FY 89-94)		
MDC 8: Musculoskeletal System	22	18	Down 18%	22	17	Down 23%	25	22	Down 12%	<ul style="list-style-type: none">For both men and women, rates of musculoskeletal system diseases declined in the 6 years from FY 1989-1994. However, musculoskeletal system diseases still remains the leading cause of hospitalization.The percentage of musculoskeletal system diseases were lower for men than for women from FY 1989 to 1994.Overall, alcohol/drug hospitalization rates showed the greatest decline over this 6-year period.	
MDC 6: Digestive System	10	7	Down 30%	10	7	Down 30%	14	8	Down 43%		
MDC 20: Alcohol & Drugs	10	5	Down 50%	10	5	Down 50%	8	4	Down 50%		
MDC 3: Ear, Nose, Mouth, & Throat	4	4	No change	4	4	No change	6	8	Up 33%		
MDC 19: Mental Disorders	4	4	No change	4	4	No change	10	9	Down 10%		
MDC 9: Skin & Breast	6	4	Down 33%	6	3	Down 50%	10	6	Down 40%		
MDC 14: Pregnancy	4	3	Down 25%	—	—	—	85	70	Down 18%		
MDC 4: Respiratory System	2	3	Up 50%	2	3	Up 50%	—	—	—		
MDC 18: Infectious & Parasitic	—	—	—	4	1	Down 75%	—	—	—		
MDC 12: Male Repro System	2	2	No change	—	—	—	—	—	—		
MDC 13: Female Repro System	—	—	—	—	—	—	33	22	Down 33%		
MDC 11: Kidney & Urinary	—	—	—	—	—	—	5	3	Down 40%		
MDC 1: Nervous System	3	2	Down 33%	3	2	Down 33%	6	3	Down 50%		
MDC 5: Circulatory System	—	—	—	2	2	No change	—	—	—		

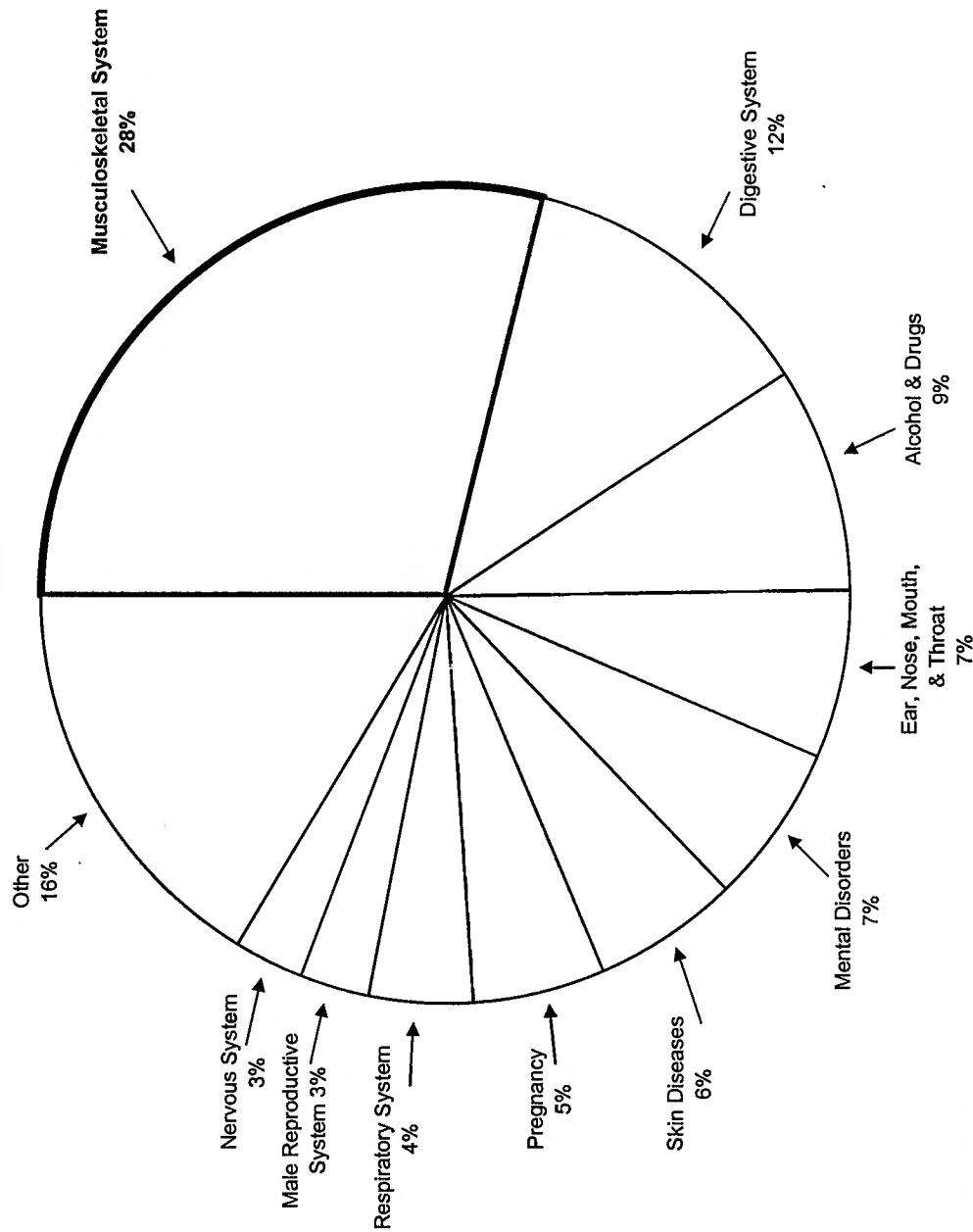
Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.

Figure 5-22 illustrates the distribution of 10,992 hospitalizations by major diagnostic categories for active duty Marine Corps personnel for FY 1994. The top five contributors accounted for 63% of all hospitalizations:

- Musculoskeletal system (MDC 8)—28%.
- Digestive system (MDC 6)—12%.
- Alcohol/drugs (MDC 20)—9%.
- Ear, nose, mouth, and throat (MDC 3)—7%.
- Mental disorders (MDC 19)—7%.

In the MDC scheme, virtually all injuries are included in the musculoskeletal system group. As a result, the injury MDC is not ranked as one of the top 10 contributors to hospitalizations.

Marine Corps - Distribution (%) of Hospitalizations by Major Diagnostic Category,* FY 1994



n = 10,992.

* Major diagnostic categories from the *DRG Guidebook*, 1996.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

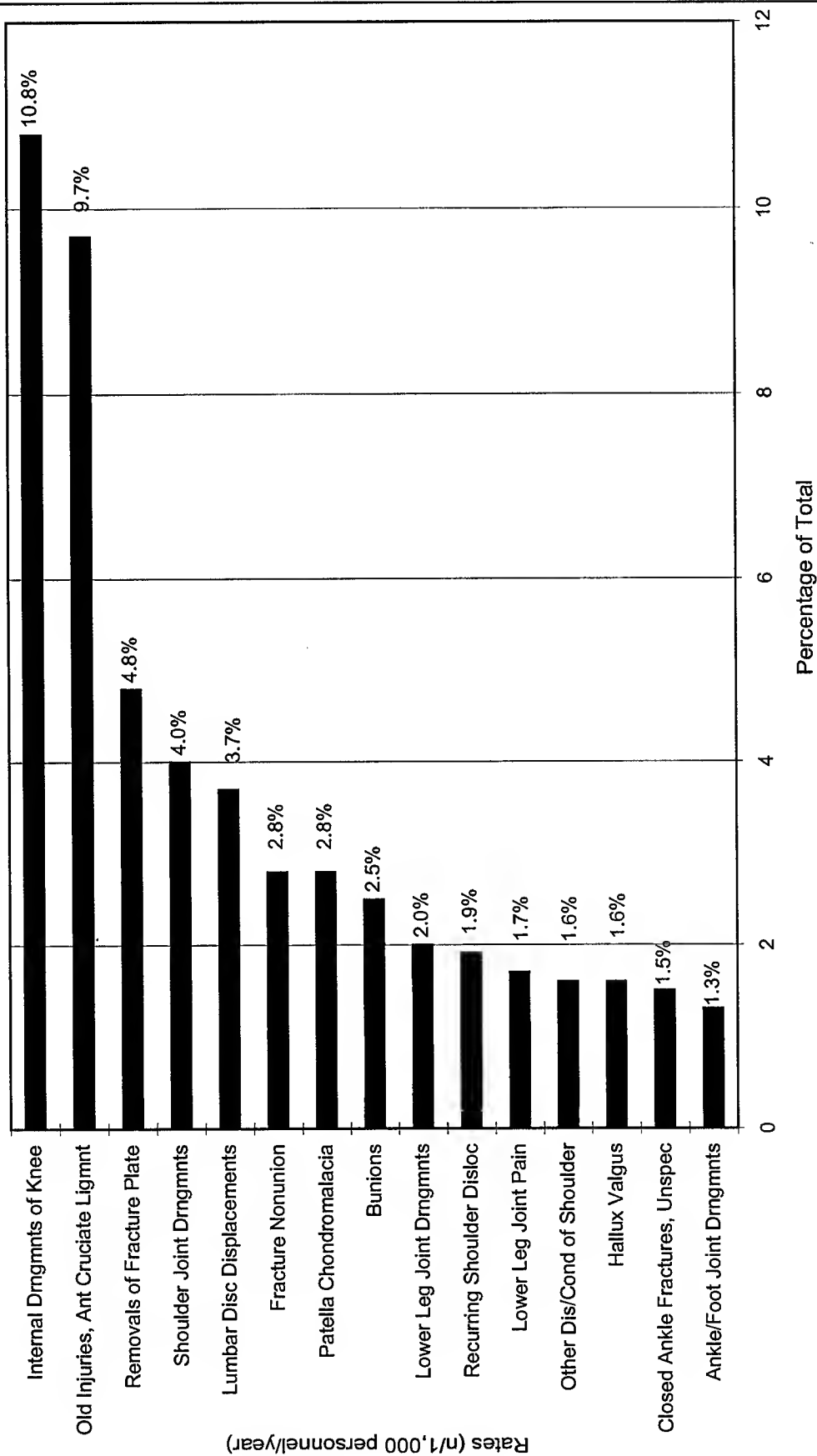
Figure 5-22

Figure 5-23 illustrates the distribution of the top 15 musculoskeletal system diagnoses for hospitalized active duty male Marine Corps personnel for FY 1994. Of a total of 3,010 hospitalizations, the top five contributors accounted for 33% of all hospitalizations:

- Internal derangement of the knee—10.8%.
- Old injury of anterior cruciate ligament—9.7%.
- Removal of fracture plate—4.8%.
- Shoulder joint derangement—4.0%.
- Lumbar disc displacement—3.7%.

Among male Marine Corps personnel, most of these musculoskeletal system diseases appear to be injury related.

Marine Corps - Distribution (%) of Top 15 Musculoskeletal System Diagnoses for Hospitalized Men, FY 1994



Total musculoskeletal hospitalizations = 3,010.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

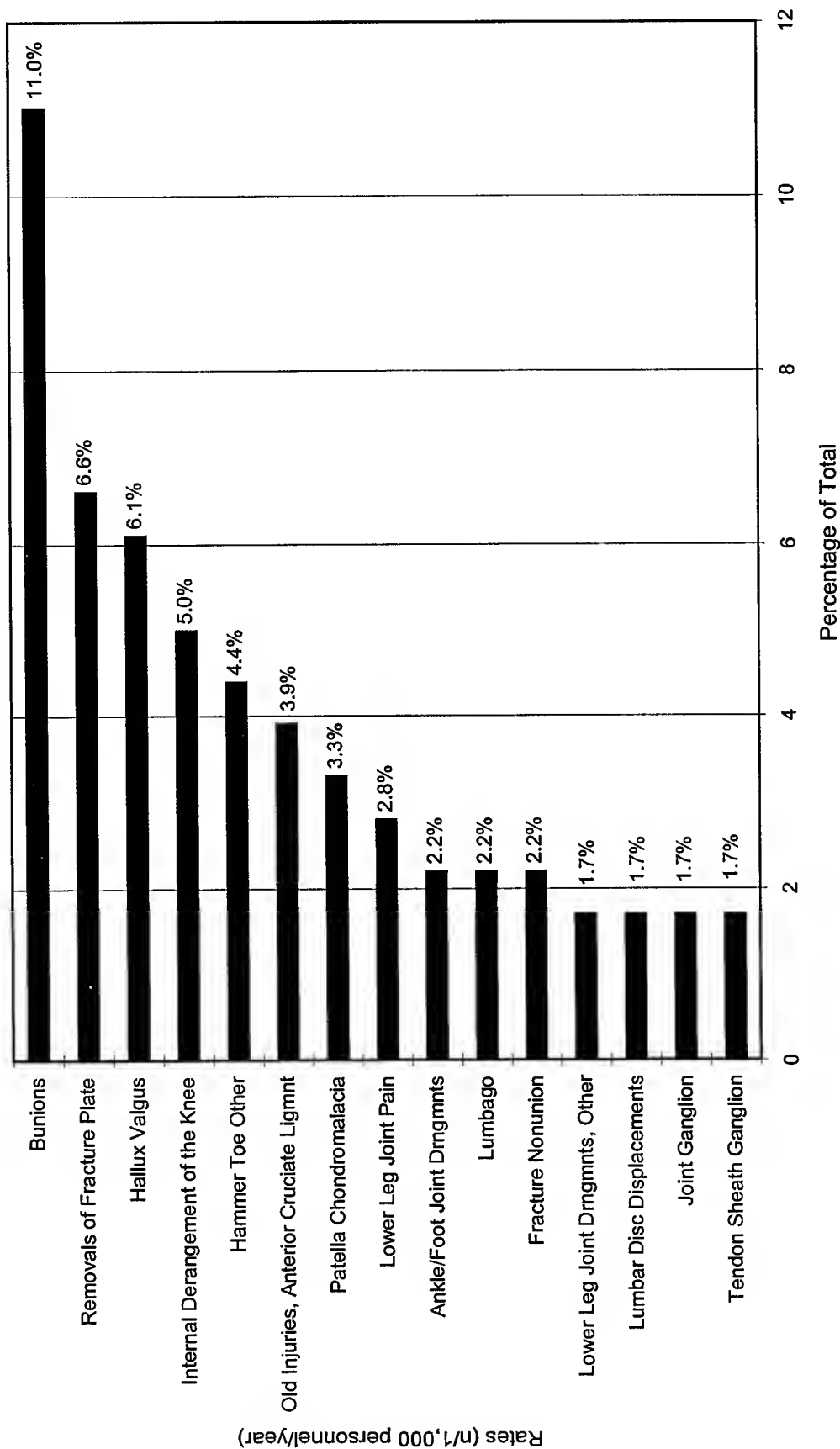
Figure 5-23

Figure 5-24 illustrates the top 15 musculoskeletal system diagnoses for hospitalized active duty female Marine Corps personnel for FY 1994. Of a total of 181 hospitalizations, the top five contributors accounted for 23% of all hospitalizations:

- Bunion—11.0%.
- Removal of fracture plate—6.6%.
- Hallux valgus—6.1%.
- Internal derangement of the knee—5.0%.
- Hammer toe other—4.4%.

Among female Marine Corps personnel, many of these musculoskeletal system diseases appear to be injury related.

Marine Corps - Distribution (%) of Top 15 Musculoskeletal System Diagnoses for Hospitalized Women, FY 1994



Total musculoskeletal hospitalizations = 181.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-24

Trends of Marine Corps Total Hospitalizations Over Time.

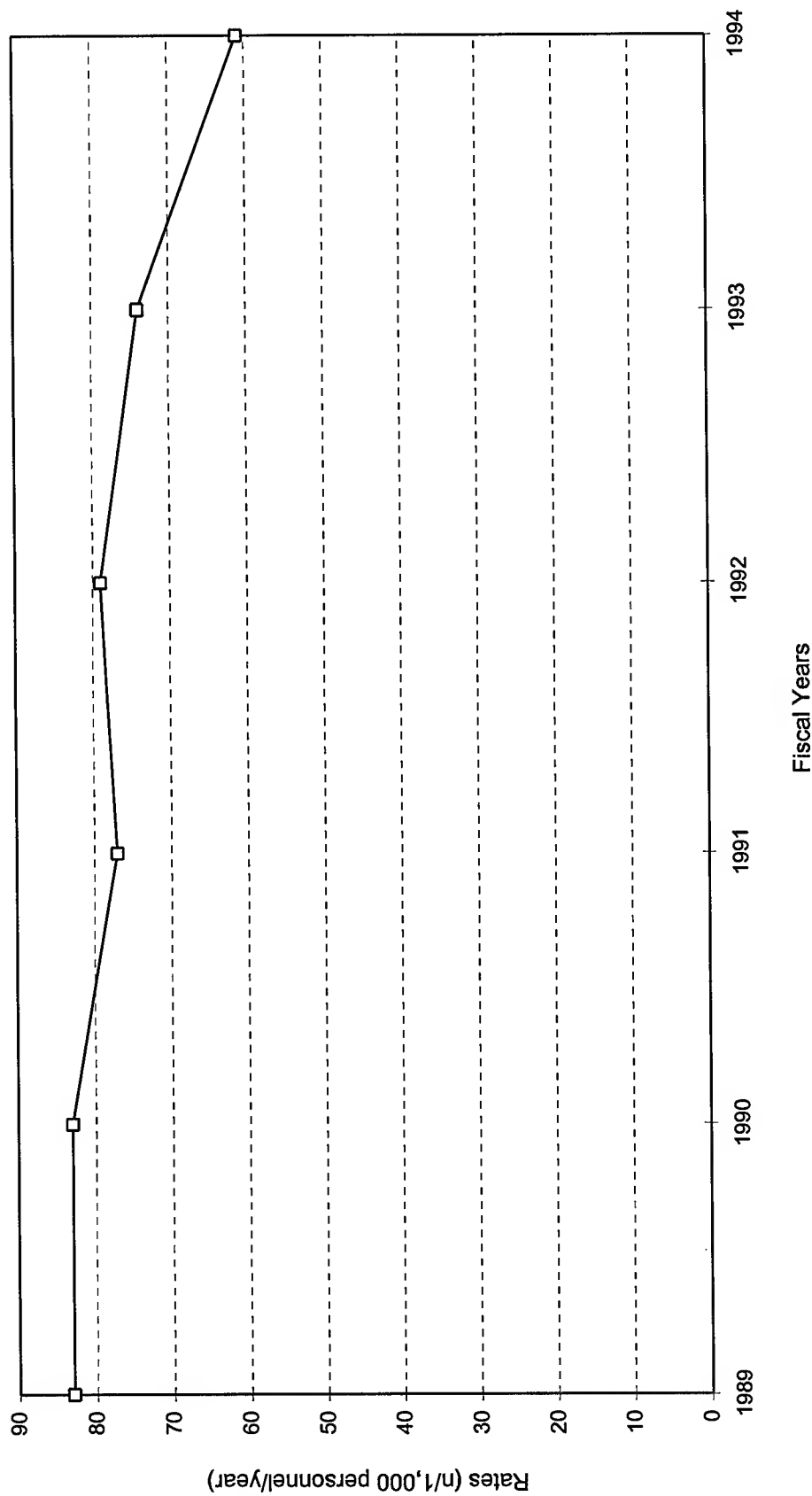
Figure 5-25 illustrates the rates of hospitalization by year for active duty Marine Corps personnel for FY 1989-1994. Hospitalization rates decreased 27% from 83 per 1,000 personnel in FY 1989 to 61 per 1,000 personnel in FY 1994.

Worksheet Data for Figure 5-25

Marine Corps - Rates of Hospitalization by Fiscal Year*					
1989	1990	1991	1992	1993	1994
83	83	77	79	74	61

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Marine Corps - Rates of Hospitalization by Year, FY 1989-1994



Numerator Source: Naval Medical Information Management Center, Bethesda, MD, 1995.
 Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIORM07-96/01).

Figure 5-25

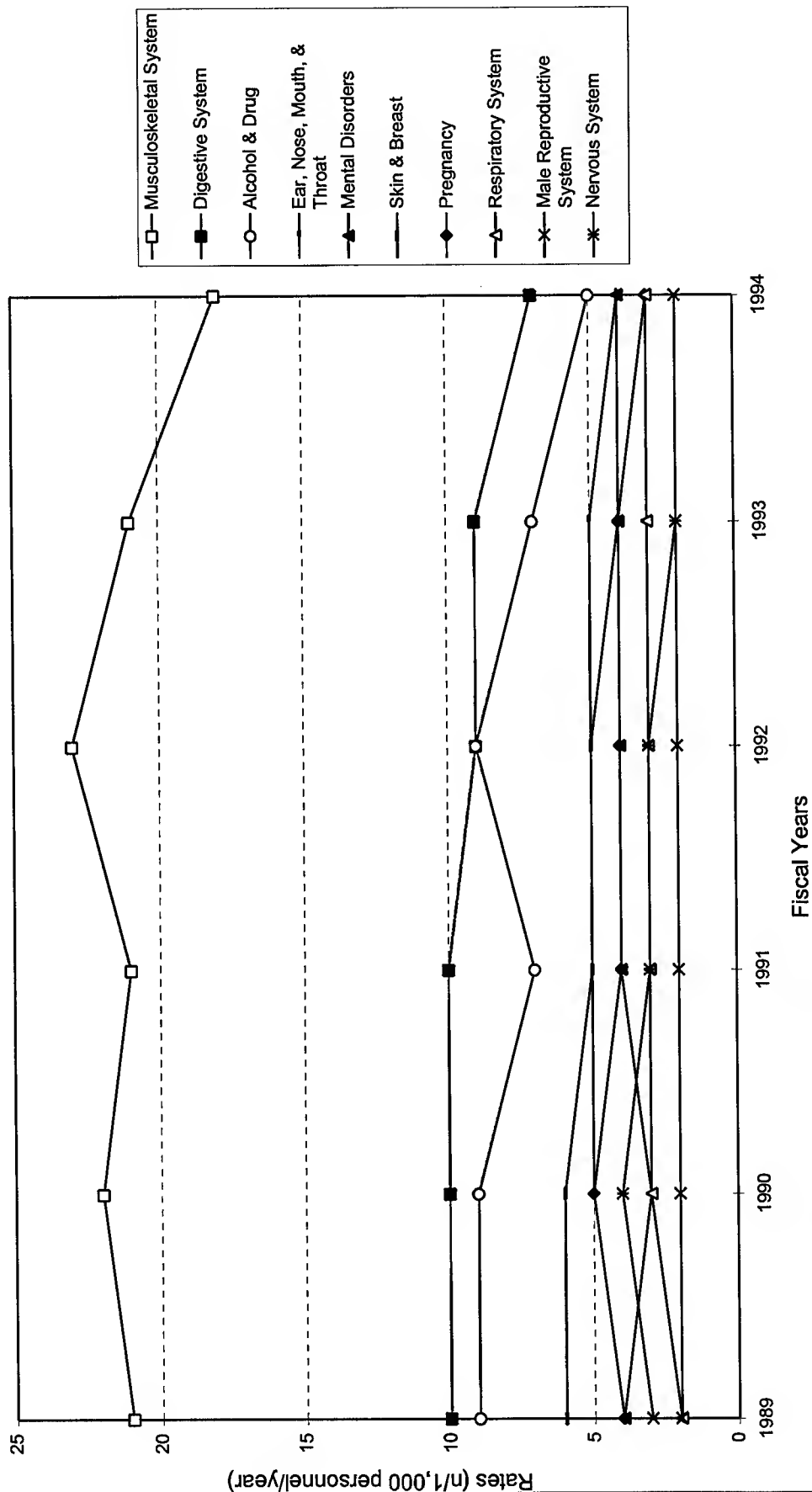
Figure 5-26 illustrates the rates of the top 10 causes of hospitalization by MDC for active duty Marine Corps personnel for FY 1989-1994. Musculoskeletal system diseases decreased 18% from 22 per 1,000 personnel in FY 1989 to 18 per 1,000 personnel in FY 1994.

Worksheet Data for Figure 5-26

Top 10 Causes of Hospitalization by Major Diagnostic Category (Rank Based on 1994 Data)	Marine Corps - Rates of Hospitalization by Fiscal Year*					
	1989	1990	1991	1992	1993	1994
MDC 8: Musculoskeletal System	22	22	21	23	21	18
MDC 6: Digestive System	10	10	10	9	9	7
MDC 20: Alcohol & Drugs	10	9	7	9	7	5
MDC 3: Ear, Nose, Mouth, & Throat	4	5	5	5	5	4
MDC 19: Mental Disorders	4	3	4	4	4	4
MDC 9: Skin & Breast	6	6	5	5	5	4
MDC 14: Pregnancy	4	5	4	4	4	3
MDC 4: Respiratory System	2	3	3	3	3	3
MDC 12: Male Reproductive System	2	2	2	2	2	2
MDC 1: Nervous System	3	4	3	3	2	2

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Marine Corps - Rates of Top 10 Causes of Hospitalization by Major Diagnostic Category,* FY 1989-1994



* Major diagnostic categories from the DRG Guidebook, 1996.

Numerator Source: Naval Medical Information Management Center, Bethesda, MD, 1995.
Denominator Source: DoD Worldwide U.S. Active Duty Military Personnel Casualties, Oct 79-Dec 95. Prepared by DoD, Washington Headquarters Services, Directorate for Information Operations and Reports (DTIC# DIORM07-96/01).

Figure 5-26

Figure 5-27 illustrates the top 10 causes of hospitalization by MDC for active duty male Marine Corps personnel for FY 1989-1994.

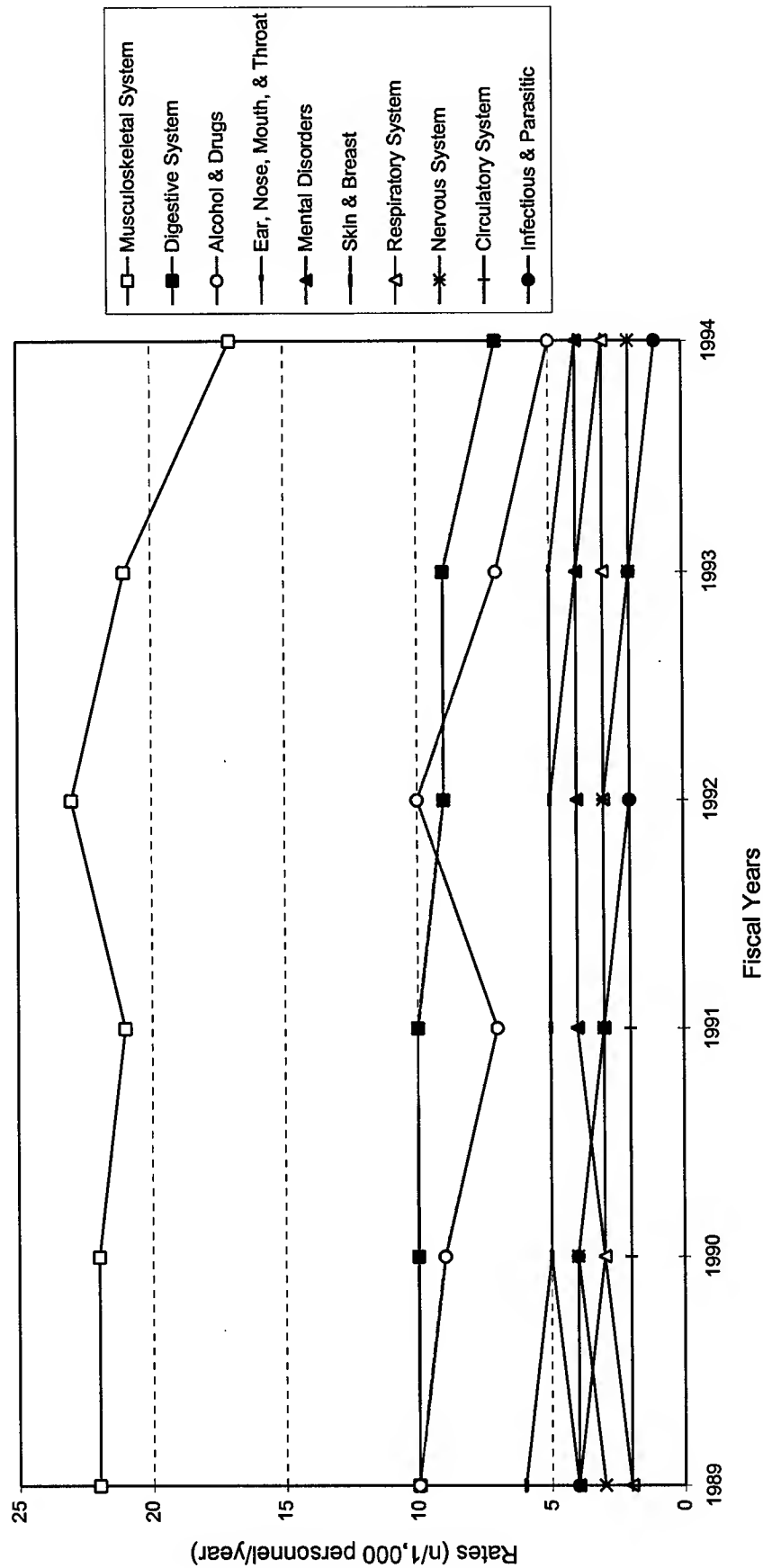
- Rates of musculoskeletal system hospitalizations decreased 23% from 22 per 1,000 personnel in FY 1989 to 17 per 1,000 personnel in FY 1994.
- Rates of musculoskeletal system hospitalizations were between two to three times higher than the rates for the second and third leading categories, digestive system and alcohol and drugs, respectively.
- Rates of most other categories of hospitalization remained fairly constant among the top 10 for men with a possible decrease in infectious disease rates.

Worksheet Data for Figure 5-27

Top 10 Causes of Hospitalization for Men by Major Diagnostic Category (Rank Based on 1994 Data)	Marine Corps - Rates of Hospitalization by Fiscal Year*				
	1989	1990	1991	1992	1994
MDC 8: Musculoskeletal System	22	22	21	23	17
MDC 6: Digestive System	10	10	10	9	7
MDC 20: Alcohol & Drugs	10	9	7	10	5
MDC 3: Ear, Nose, Mouth, & Throat	4	5	5	5	4
MDC 19: Mental Disorders	4	3	4	4	4
MDC 9: Skin & Breast	6	5	5	5	3
MDC 4: Respiratory System	2	3	3	3	3
MDC 1: Nervous System	3	4	3	3	2
MDC 5: Circulatory System	2	2	2	2	2
MDC 18: Infectious & Parasitic	4	4	3	2	1

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Marine Corps - Rates of Top 10 Causes of Hospitalization for Men by Major Diagnostic Category,* FY 1989-1994



* Major diagnostic categories from the DRG Guidebook, 1996.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-27

Figure 5-28 illustrates the top 10 causes of hospitalization by MDC for active duty female Marine Corps personnel for FY 1989-1994.

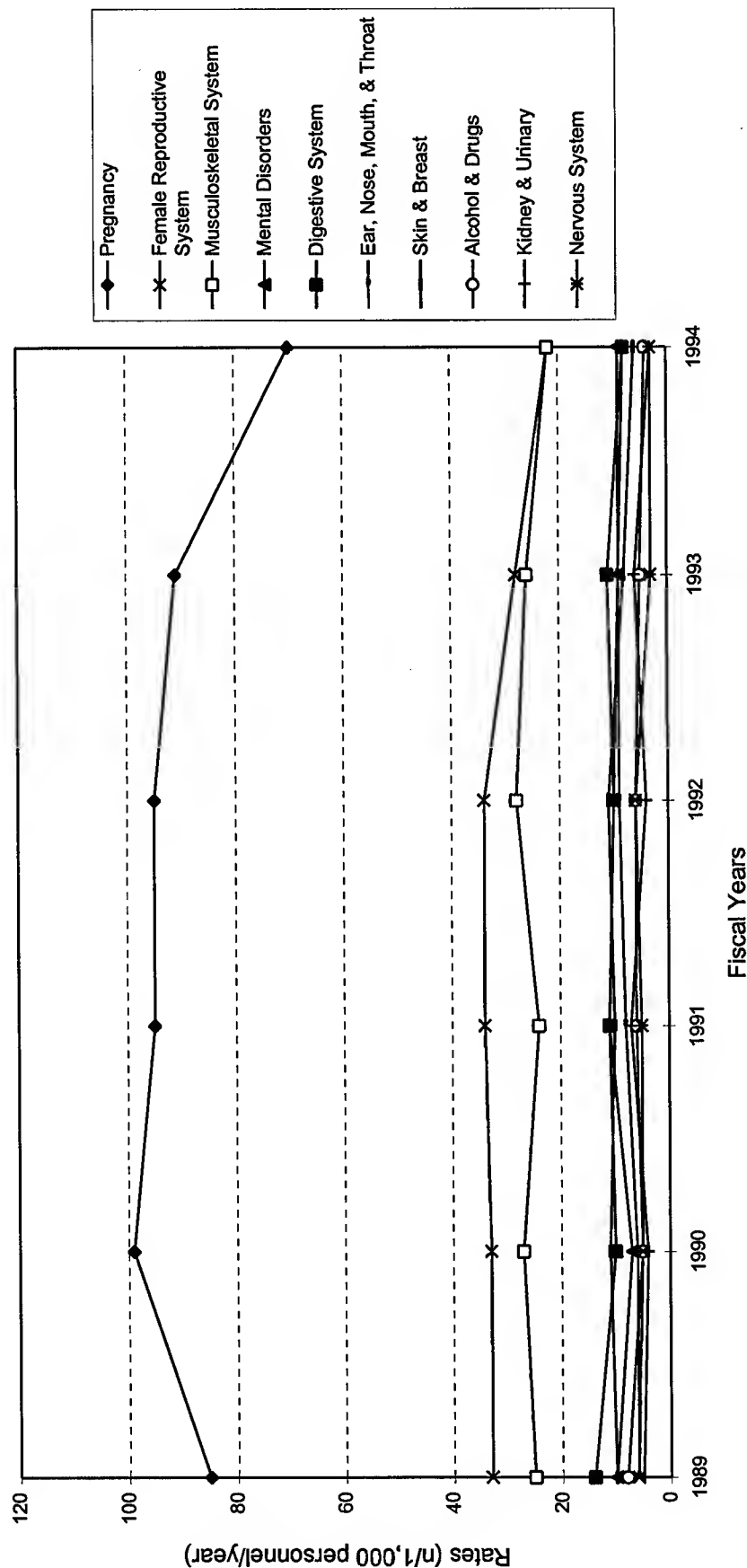
- Musculoskeletal system diseases were the third most common reason for hospitalizations among women in the Marine Corps.
- Rates of musculoskeletal system diseases decreased only 12% from FY 1989-1994.
- Although musculoskeletal system diseases were only the third leading cause of hospitalizations among women, the rates were higher than for men, for whom they were number one.

Worksheet Data for Figure 5-28

Top 10 Causes of Hospitalization for Women by Major Diagnostic Category (Rank Based on 1994 Data)	Marine Corps - Rates of Hospitalization by Fiscal Year*				
	1989	1990	1991	1992	1993
MDC 14: Pregnancy	85	99	95	95	91
MDC 13: Female Reproductive System	33	33	34	34	28
MDC 8: Musculoskeletal System	25	27	24	28	26
MDC 6: Digestive System	14	10	11	10	11
MDC 19: Mental Disorders	10	7	11	10	9
MDC 3: Ear, Nose, Mouth, & Throat	6	6	8	9	9
MDC 9: Skin & Breast	10	11	10	11	8
MDC 20: Alcohol & Drug	8	5	6	6	5
MDC 11: Kidney & Urinary	5	4	7	4	6
MDC 1: Nervous System	6	5	5	6	3

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Marine Corps - Rates of Top 10 Causes of Hospitalization for Women by Major Diagnostic Category, * FY 1989-1994



* Major diagnostic categories from the DRG Guidebook, 1996.

Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-28

Figure 5-29 illustrates the rates of hospitalization for musculoskeletal system diagnoses for active duty Marine Corps men and women for FY 1989-1994.

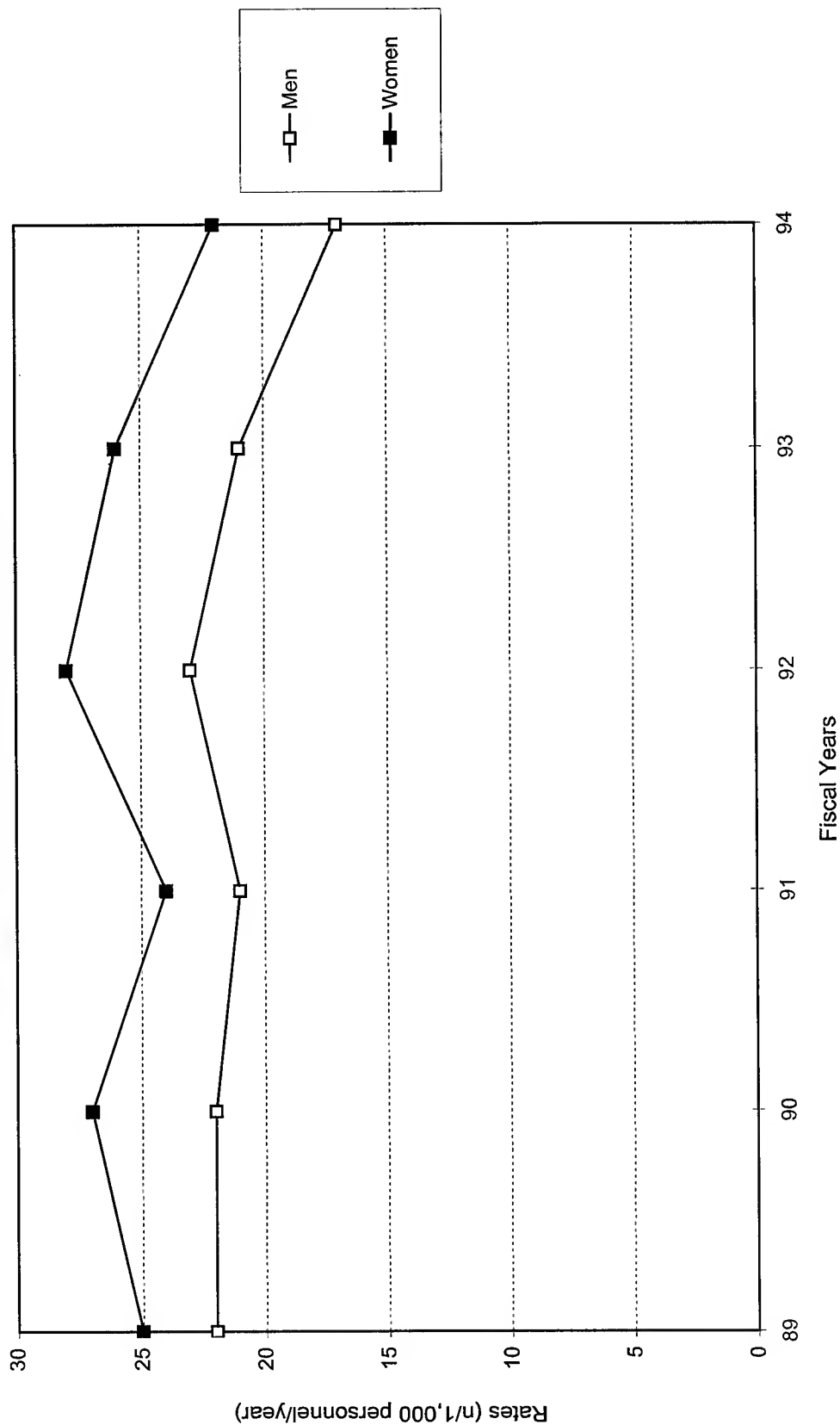
- Musculoskeletal system condition rates for women decreased 12% from 25 per 1,000 personnel in FY 1989 to 22 per 1,000 personnel in FY 1994.
- Musculoskeletal system condition rates for men decreased 23% from 22 per 1,000 personnel in FY 1989 to 17 per 1,000 personnel in FY 1994.

Worksheet Data for Figure 5-29

Musculoskeletal System Diagnoses	Marine Corps - Rates of Hospitalization by Fiscal Year*					
	1989	1990	1991	1992	1993	1994
Women	25	27	24	28	26	22
Men	22	22	21	23	21	17

* Rates per 1,000 personnel calculated using denominator data in Table 1-8.

Marine Corps - Rates of Hospitalization for Musculoskeletal System Diagnoses for Men and Women, FY 1989-1994



Source: Naval Medical Information Management Center, Bethesda, MD, 1995.

Figure 5-29

Table 5-14 displays the frequency and case rates by major diagnostic categories for hospitalized active duty Marine Corps men and women for FY 1994.

- The top three hospitalization rates for men in 1994 were:
 - Musculoskeletal system (MDC 8)—17.4.
 - Digestive system (MDC 6)—7.2.
 - Alcohol and drugs (MDC 20)—5.4.
- The top three hospitalization rates for women in 1994 were:
 - Pregnancy and childbirth (MDC 14)—70.3.
 - Female reproductive system (MDC 13)—22.4.
 - Musculoskeletal system (MDC 8)—22.1.
- Musculoskeletal system diseases were one of the top three contributors to hospitalization case rates for both men and women.

Table 5-14. Marine Corps - Frequency (n) and Case Rates by Major Diagnostic Category for Hospitalized Active Duty Men and Women, FY 1994

Major Diagnostic Categories	Men		Women		Total	
	n	Case Rate*	n	Case Rate	n	Case Rate
MDC 8: Musculoskeletal System	3,010	17.4	181	22.1	3,191	17.6
MDC 6: Digestive System	1,240	7.2	64	7.8	1,304	7.2
MDC 20: Alcohol & Drugs	928	5.4	31	3.8	959	5.3
MDC 3: Ear, Nose, Mouth, & Throat	669	3.9	67	8.2	736	4.1
MDC 19: Mental Disorders	644	3.7	72	8.8	716	4.0
MDC 9: Skin & Breast	590	3.4	48	5.9	638	3.5
MDC 14: Pregnancy	0	0.0	575	70.3	575	3.2
MDC 4: Respiratory System	440	2.5	17	2.1	457	2.5
MDC 12: Male Reproductive System	308	1.8	0	0.0	308	1.7
MDC 1: Nervous System	282	1.6	25	3.1	307	2
MDC 5: Circulatory System	293	1.7	10	1.2	303	1.7
MDC 21: Injury	275	1.6	22	2.7	297	1.6
MDC 18: Infectious & Parasitic	185	1.1	9	1.1	194	1.1
MDC 13: Female Reproductive System	0	0.0	183	22.4	183	1.0
MDC 11: Kidney & Urinary	132	0.8	26	3.2	158	0.9
Ungroupable	125	0.7	14	1.7	139	0.8

Table 5-14.—Continued

Major Diagnostic Categories	Men		Women		Total	
	n	Case Rate*	n	Case Rate	n	Case Rate
MDC 2: Eye	124	0.7	2	0.2	126	0.7
MDC 23: Health Status	87	0.5	5	0.6	92	0.5
MDC 10: Endocrine, Nutritional, & Metabolic	79	0.5	15	1.8	94	0.5
MDC 7: Liver & Pancreas	77	0.4	9	1.1	86	0.5
MDC 16: Blood & Immunology	56	0.3	4	0.5	60	0.3
MDC 17: Neoplasms	51	0.3	3	0.4	54	0.3
MDC 22: Burns	15	0.1	0	0.0	15	0.1
Totals	9610	55.7	1382	169.0	10992	61.0

* Case rate = number of persons hospitalized per 1,000 personnel per year.

Source: Naval Medical Information Management Center, Bethesda, MD, 1996. Rates calculated using population data in Table 1-8.

5-9. Air Force

The Air Force hospitalization data are presented in four parts:

- The Air Force Summary. The Air Force hospitalization data presented in this section are summarized in three tables.
 - The overall summary is presented in Table 5-15.
 - The data in figures 5-30 and 5-31 are summarized in Table 5-16.
 - The data in figures 5-34, 5-36, and 5-37 are summarized in Table 5-17.
- Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.
 - The distribution of hospitalizations and non-effective days due to hospitalization by principal diagnosis group for CY 1994 is displayed in figures 5-30 and 5-31, respectively.
- Trends of Air Force Injury-Related Hospitalizations Over Time.
 - The rates of hospitalization by year and by top 10 principal diagnosis groups for CY 1980-1994 are displayed in figures 5-32 and 5-33, respectively.
 - The frequency, case rates, and NERs by principal diagnosis group for hospitalized men and women for CY 1994 are displayed in Table 5-18.
- Hospitalizations by External Causes of Injury.
 - The distribution of hospitalizations by external causes of injury for CY 1994 is displayed in Figure 5-34.
 - The rates of hospitalization coded by external cause of injury for CY 1980-1994 are displayed in Figure 5-35.
 - The rates and NERs of hospitalizations for the top 10 external causes of injury for CY 1980-1994 are displayed in figures 5-36 and 5-37, respectively.
 - The frequency, case rates, and NERs by external causes of injury for hospitalized men and women for CY 1994 are displayed in Table 5-19.

The Air Force Summary.

Table 5-15. Overall Summary of Air Force Hospitalization Data for Active Duty Personnel

Year	Total Air Force Population	Hospitalizations		Rates and Trends of Hospitalizations		Conclusion
		Total	n/1,000 Personnel /Day	n/1,000 Personnel /Year	Trend, % Change (CY 1980-1994)	
CY80-94 CY94	— 427,790*	— 42,479	— 100	155 (CY80) —	100 (CY94) —	Overall hospitalization rates in the Air Force have declined over this 15-year period.

* Obtained from the Medical Information Systems Division, Directorate of Health Care Support, Office of The Surgeon General, U.S. Air Force, 1993.

Table 5-16. Summary of Air Force Hospitalization Distribution Data by Principal Diagnosis Group, CY 1994

Principal Diagnosis Groups	ICD-9 Codes	Distribution (%)		Conclusions
		Hospitalizations (n = 42,479)	Non-Effective Days (n = 163,309)	
Digestive System	520-579	22%	10%	Hospitalizations <ul style="list-style-type: none"> • Digestive system disease is the leading cause of hospitalization in the Air Force. • When musculoskeletal system diseases and injury principal diagnosis groups are combined (injuries may be coded as musculoskeletal system diseases), they account for 22% of all hospitalizations. Non-Effective Days <ul style="list-style-type: none"> • Mental disorders account for the greatest percentage of non-effective days. • Musculoskeletal system diseases and injury principal diagnosis groups combined account for 18% of the total non-effective days.
Musculoskeletal System	710-739	14%	9%	
Pregnancy	630-676	13%	10%	
Injury	800-999	8%	9%	
Genitourinary System	580-629	7%	4%	
Mental Disorders	290-319	6%	33%	
Respiratory System	460-519	6%	3%	
Circulatory System	390-459	3%	3%	
Ill-Defined Conditions	780-799	3%	—	
Nervous System	320-389	3%	—	
Neoplasms	140-239	3%	4%	
Other*	—	12%	15%	

* Includes groups less than 3% each.

Table 5-17. Summary of Air Force Hospitalization Data by External Cause of Injury, CY 1994

External Causes of Injury*	Distribution (%) of Hospitalizations (n=4,943)	Rate of Hospitalizations (per 1,000 personnel per year)	NER† (per 100,000 personnel per day)	Conclusions
Athletics/Sports Injuries	23%	2.6	2.3	<ul style="list-style-type: none"> When looking only at nonmedical causes of injury, athletics/sports were the leading cause of injury hospitalization for the Air Force in CY 1994, and the second leading cause of non-effective days. Complications of medical/surgical procedures were second as a percentage of hospitalizations, but were the leading cause in terms of the NER. When looking only at nonmedical causes of injury, motor vehicle accidents were the second most common cause of injury hospitalization and the leading cause of non-effective days.
Complications of Medical/Surgical Procedures	22%	2.6	4.9	
Motor Vehicle Accidents	10%	1.1	2.9	
Falls/Jumps	8%	0.9	1.1	
Late Effects of Injury	5%	0.6	0.8	
Poisoning by Ingestion	3%	0.4	1.3	
Twists/Turns/Slips	3%	0.4	0.3	
Cut/Pierce by Objects	3%	0.4	0.5	
Guns/Explosives	2%	0.2	0.2	
Fighting	2%	0.2	0.2	
Other‡	19%	—	—	

* NATO STANAG codes.

† NER = total sick days per 100,000 personnel per day. This is a different calculation than that used by the Army.

‡ Includes Unknown/Unspecified Agents (8%), Codes Not Specified (3%), and all causes accounting for less than 1.5%.

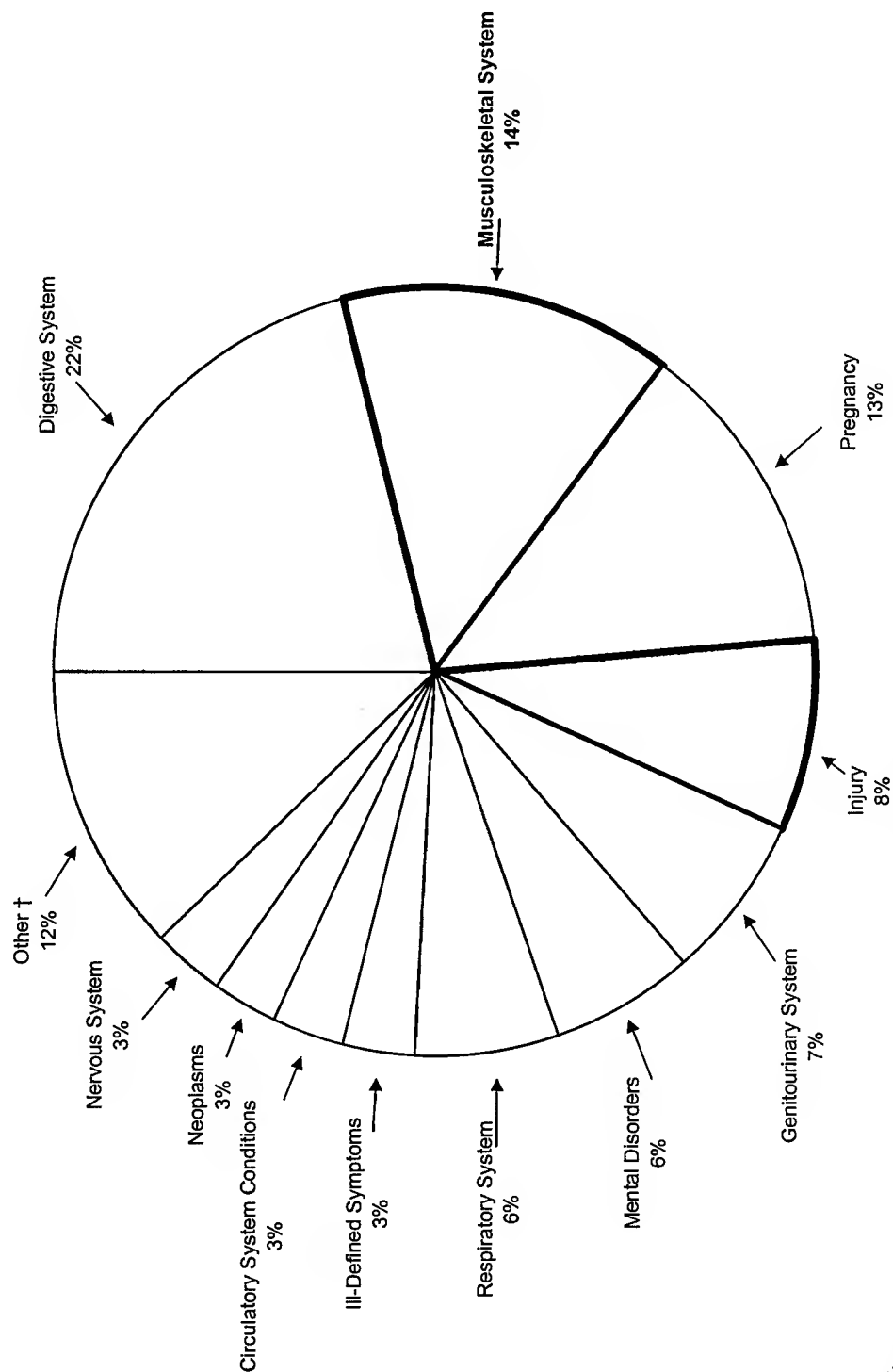
Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses.

Figure 5-30 illustrates the distribution of 42,479 hospitalizations by principal diagnosis group for active duty Air Force personnel for CY 1994. The top five contributors to hospitalization were:

- Digestive system (ICD-9 codes 520-579)—22%.
- Musculoskeletal system (ICD-9 codes 710-739)—14%.
- Pregnancy (ICD-9 codes 630-676)—13%.
- Injury (ICD-9 codes 800-999)—8%.
- Genitourinary system (ICD-9 codes 580-629)—7%.

When musculoskeletal system diseases, which are largely injury related, and injury diagnosis groups are combined, they account for 22% of all admissions. This combined group of injury-related hospitalizations is equal to digestive system disorders, the leading category of hospitalizations.

Air Force - Distribution (%) of Hospitalizations by Principal Diagnosis Group for Active Duty Personnel, CY 1994*



n - 42,479.

* Principal diagnosis groups from the *International Classification of Diseases*, 9th Edition.

† Includes Infectious & Parasitic (2%), Skin Diseases (2%), Congenital Anomalies (1%), Endocrine, Nutritional, & Metabolic (1%), and Other (6%).

Source: Inpatient database, Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

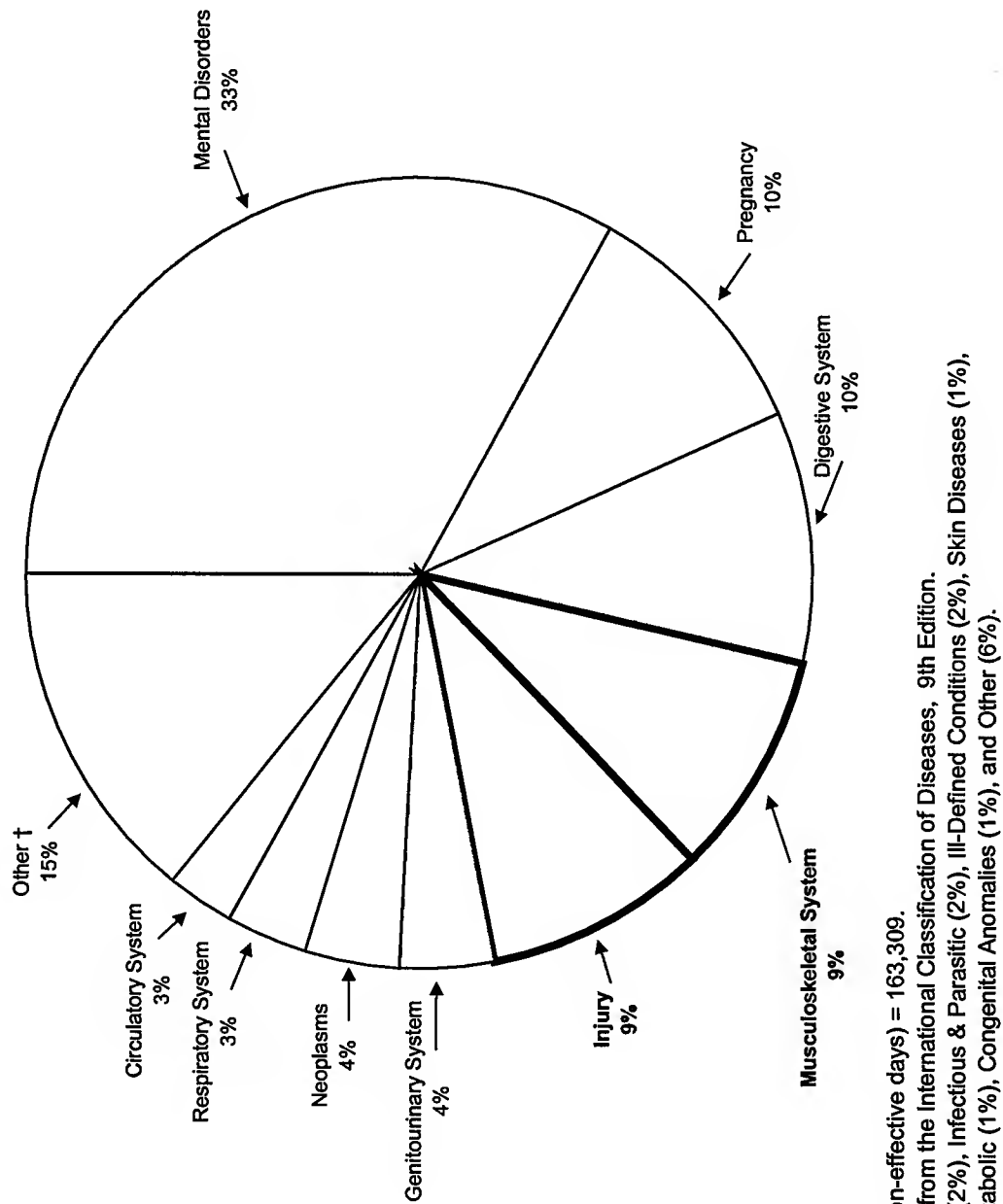
Figure 5-30

Figure 5-31 illustrates the distribution of non-effective days due to hospitalization by principal diagnosis group for active duty Air Force personnel for CY 1994. The approximate number of non-effective days for CY 1994 was 163,309 days, with the following top five contributors:

- Mental disorders (ICD-9 codes 290-319)—33%.
- Pregnancy (ICD-9 codes 630-676)—10%.
- Digestive system (ICD-9 codes 520-579)—10%.
- Musculoskeletal system (ICD-9 codes 710-739)—9%.
- Injury (ICD-9 codes 800-999)—9%.

Hospitalizations coded as musculoskeletal system diseases, are largely injury related when the musculoskeletal system and injury diagnosis groups are combined, they account for 18% of the total number of non-effective days, second behind mental disorders.

Air Force - Distribution (%) of Non-Effective Days Due to Hospitalization by Principal Diagnosis Group for Active Duty Personnel,* CY 1994



n (approximate number of non-effective days) = 163,309.

* Principal diagnosis groups from the International Classification of Diseases, 9th Edition.

† Includes Nervous System (2%), Infectious & Parasitic (2%), Ill-Defined Conditions (2%), Skin Diseases (1%), Endocrine, Nutritional, & Metabolic (1%), Congenital Anomalies (1%), and Other (6%).

Source: Inpatient database, Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

Figure 5-31

Air Force - Rates of Hospitalization by Year for Active Duty Personnel, CY 1980-1994

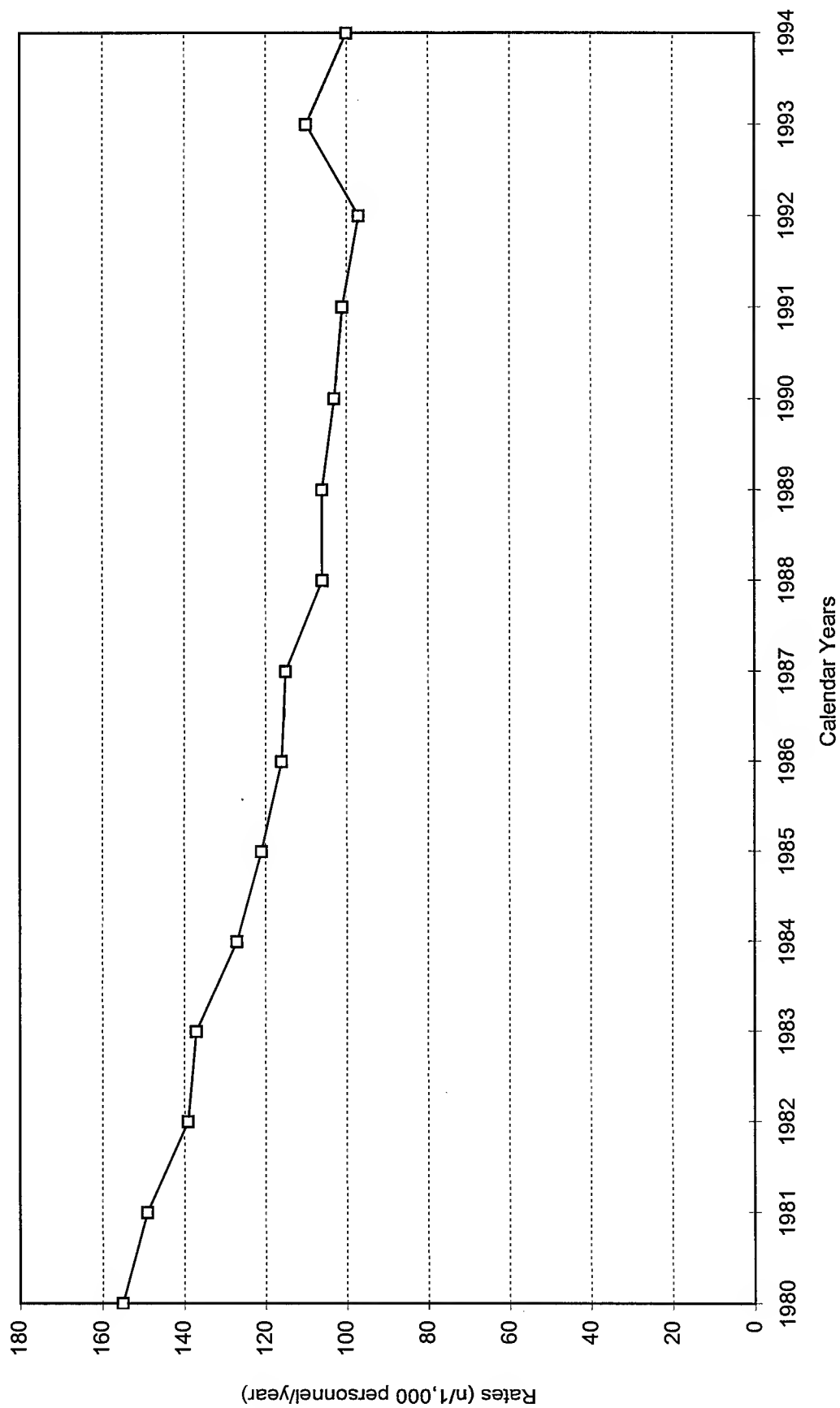


Figure 5-32

Source: Inpatient database (numerator) and military personnel extract (denominator), Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

Figure 5-33 illustrates the rates of hospitalization for the top 10 principal diagnosis groups for active duty Air Force personnel for CY 1980-1994.

- Digestive system hospitalization rates decreased 30% from a high of 31 per 1,000 personnel in CY 1983 to a low of 21 per 1,000 personnel in CY 1994.
- Musculoskeletal system hospitalization rates, the second ranked contributor, have shown little change over the period with rates of about 11 or 12 per 1,000 personnel per year for most years.
- Injury hospitalization rates decreased 59% from a high of 19 per 1,000 personnel in CY 1980 to a low of 8 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-33

Principal Diagnosis Groups (Rank Based on 1994 Data)		ICD-9 Codes	Air Force - Rates of Hospitalization by Calendar Year*														
			1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	Digestive System	520-579	29	29	29	31	29	27	27	28	30	26	25	24	22	24	21
	Musculoskeletal System	710-739	15	14	12	12	12	12	12	11	11	11	11	12	12	15	14
	Pregnancy	630-676	10	11	11	11	11	10	10	11	11	11	12	12	11	14	13
	Injury	800-999	19	18	17	16	14	14	12	12	12	10	9	8	8	9	8
	Genitourinary System	580-629	10	9	9	8	7	7	7	7	7	6	6	6	6	7	7
	Mental Disorders	290-319	13	13	11	10	10	9	9	9	9	8	8	8	7	7	6
	Respiratory System	460-519	14	13	10	9	8	7	7	7	6	6	6	6	6	7	6
	Ill-Defined Conditions	780-799	7	7	7	6	5	5	5	5	4	4	4	3	3	4	3
	Nervous System	320-389	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3
	Infectious & Parasitic	001-139	13	12	10	10	10	9	7	7	7	5	4	4	3	4	2

* Rates per 1,000 personnel.

Air Force - Rates of Hospitalization for Top 10 Principal Diagnosis Groups for Active Duty Personnel, CY 1980-1994

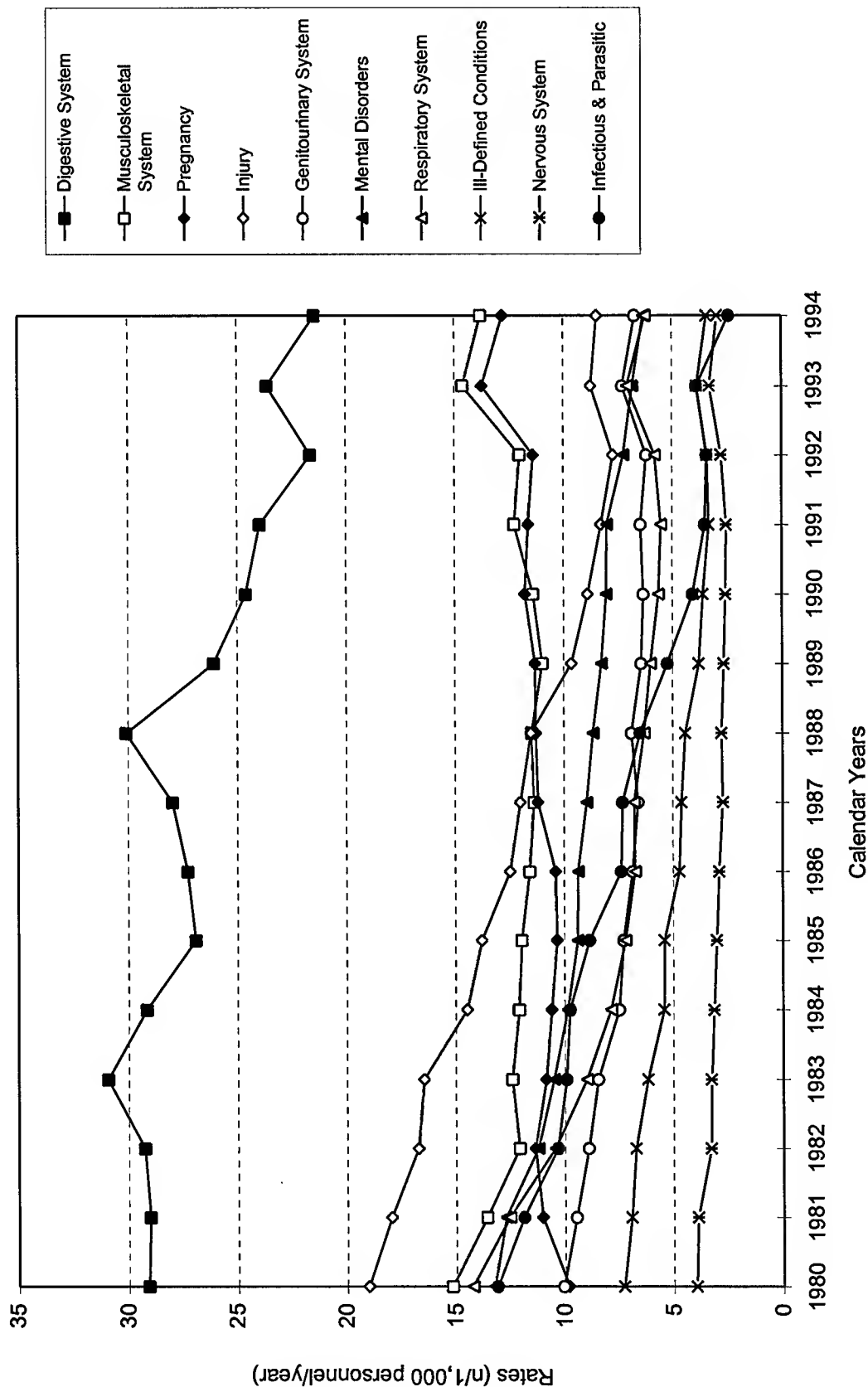


Figure 5-33

Source: Inpatient database (numerator) and military personnel extract (denominator), Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

Table 5-18 displays the frequency, case rates, and NERs by principal diagnosis group for hospitalized active duty Air Force men and women for CY 1994.

- The top 3 hospitalization rates for men in 1994 were:
 - Digestive system (ICD-9 codes 520-579)—20.16.
 - Musculoskeletal system diseases (ICD-9 codes 710-739)—13.22.
 - Injuries (ICD-9 codes 800-999)—8.61.
- The top 3 hospitalization rates for women in 1994 were:
 - Pregnancy (ICD-9 codes 630-676)—82.64.
 - Digestive system conditions (ICD-9 codes 520-579)—28.42.
 - Genitourinary system conditions (ICD-9 codes 580-629)—25.30.
- The top 3 NERs for men in 1994 were:
 - Mental disorders (ICD-9 codes 290-319)—33.44.
 - Digestive system conditions (ICD-9 codes 520-579)—10.31.
 - Injury (ICD-9 codes 800-999)—10.01.
- The top 3 NERs for women in 1994 were:
 - Pregnancy (ICD-9 codes 630-676)—72.38.
 - Mental disorders (ICD-9 codes 290-319)—50.29.
 - Genitourinary system (ICD-9 codes 580-629)—15.53.
- Case rates for the musculoskeletal system were similar for men and women.
- Injury case rates were slightly higher for men as compared to women.
- Though not in the top three case rates for men or women, mental disorders were one of the top three contributors to non-effective days for both men and women.

Table 5-18. Air Force - Frequency (n), Case Rates, and Non-Effective Rates by Principal Diagnosis Group for Hospitalized Active Duty Men and Women, CY 1994

Principal Diagnosis Groups	ICD-9 Codes	Men			Women			Total		
		n*	Case Rate†	NER‡	n	Case Rate	NER	n	Case Rate	NER
Digestive System	520-579	7,234	20.16	10.31	1,865	28.42	15.48	9,099	21.44	11.11
Musculoskeletal System	710-739	4,744	13.22	9.74	1,114	16.93	11.63	5,858	13.80	10.03
Pregnancy	630-676	0	0	0	5,423	82.64	72.38	5,423	12.79	11.19
Injury	800-999	3,089	8.61	10.01	503	7.67	9.79	3,592	8.46	9.98
Genitourinary System	580-629	1,189	3.31	2.09	1,660	25.30	15.53	2,849	6.71	4.17
Mental Disorders	290-319	2,089	5.82	33.44	594	9.05	50.29	2,683	6.32	36.05
Respiratory System	460-519	2,056	5.73	3.44	591	9.01	5.15	2,647	6.24	3.71
Ill-Defined Conditions	780-799	1,080	3.01	2.15	375	5.71	4.29	1,455	3.43	2.43
Nervous System	320-389	872	2.43	2.15	374	5.70	5.11	1,246	2.94	2.61
Neoplasms	140-239	737	2.05	3.75	498	7.59	6.45	1,235	2.91	4.16
Circulatory System	390-459	993	2.77	3.45	113	1.72	1.60	1,106	2.61	3.16
Infectious & Parasitic	001-139	775	2.15	2.34	249	3.79	3.49	1,024	2.41	2.52
Skin & Breast	680-709	573	1.60	1.16	162	2.47	1.29	735	1.73	1.18
Endocrine, Nutritional, & Metabolic	240-279	223	0.62	0.71	151	2.30	1.61	374	0.88	0.85
Congenital Anomalies	740-759	227	0.63	0.54	92	1.40	1.08	319	0.75	0.63
Blood & Blood Forming Organs	280-289	79	0.22	0.27	33	0.50	0.51	112	0.26	0.31
Other	—	1,778	4.96	3.58	944	14.39	5.44	2,722	6.41	4.33
Total	—	27,738	77.29	89.13	14,741	224.59	211.12	42,479	100.09	108.42

* n = number of hospitalizations.

† Case Rate = number of individuals hospitalized per 1,000 personnel per year.

‡ NER = total sick days per 100,000 personnel per day.

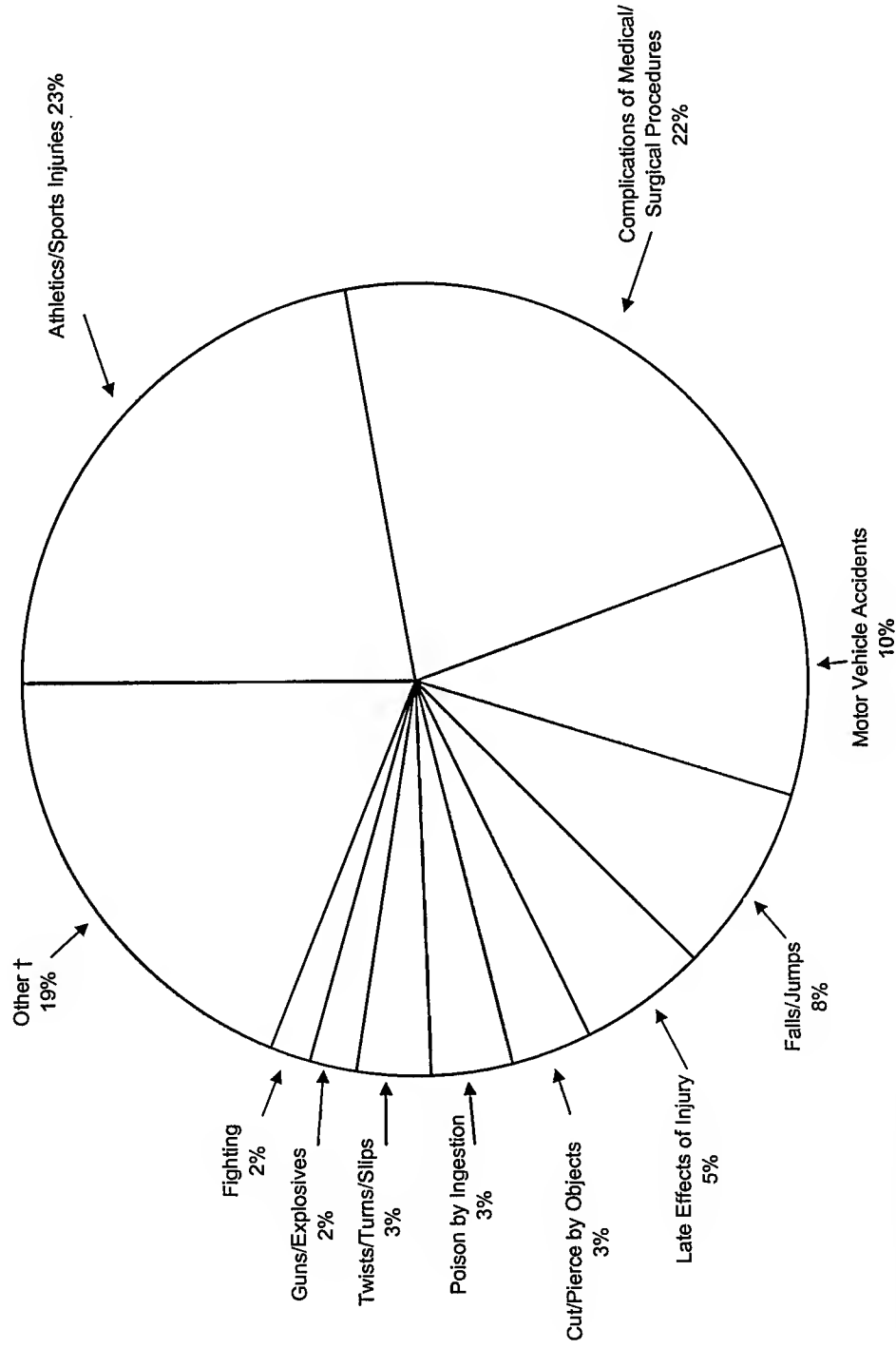
Source: Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force.

Hospitalizations by External Causes of Injury.

Figure 5-34 illustrates the distribution of hospitalizations by external causes of injury for active duty Air Force personnel for CY 1994. Of a total of 4,934 hospitalizations, the top five contributors were:

- Athletic and sports injuries—23%.
- Complications of medical or surgical procedures—22%.
- Motor vehicle accidents—10%.
- Falls and jumps—8%.
- Late effects of injuries—5%.

Air Force - Distribution (%) of Hospitalizations by External Causes of Injury* for Active Duty Personnel, CY 1994



n = 4,934.

* NATO Standard Agreement (STANAG) codes.

† Includes Unknown/Unspecified Agents (8%), Codes Not Specified (3%), and all causes accounting for less than 1.5%.

Source: Inpatient database, Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

Figure 5-34

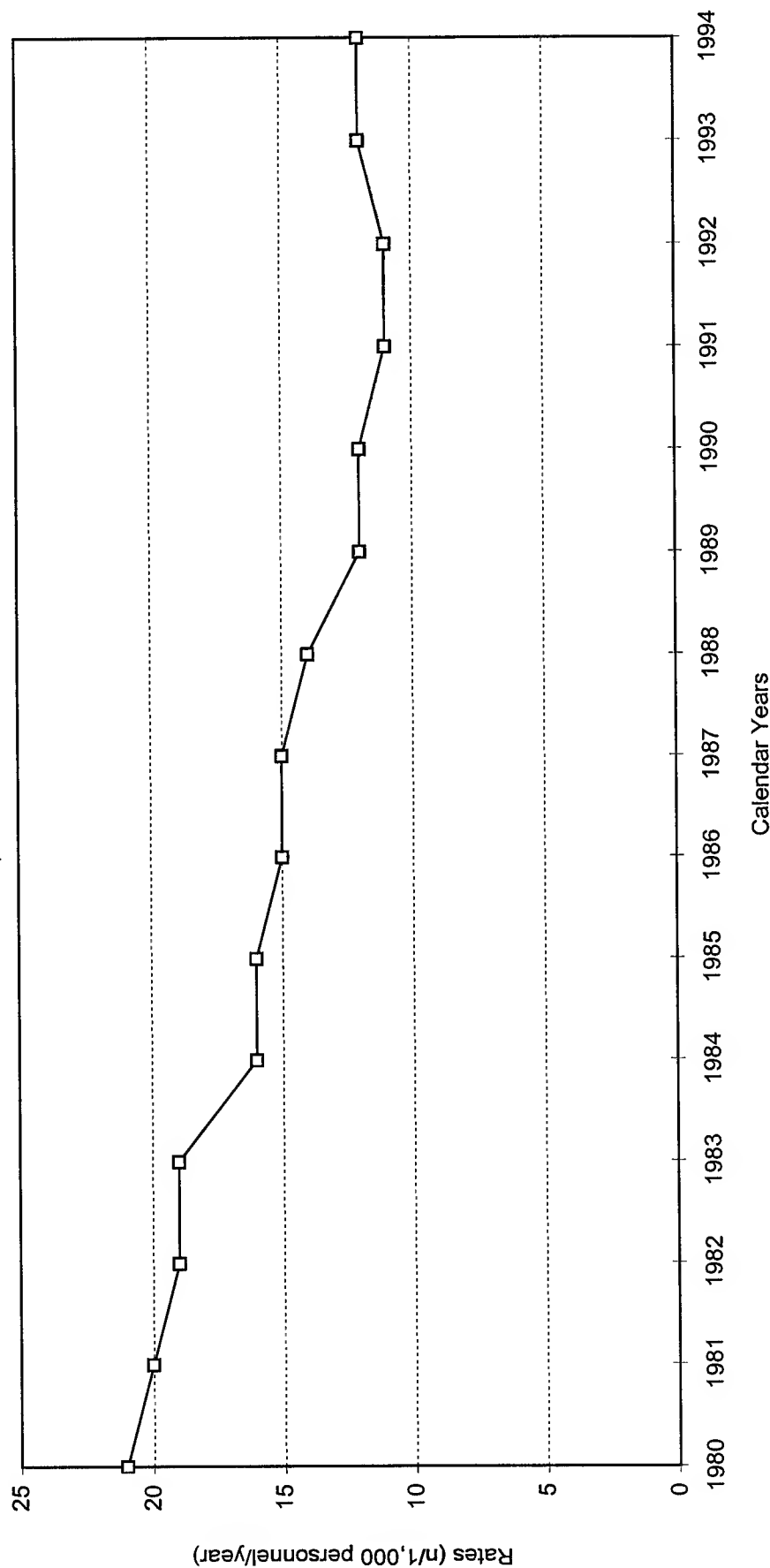
Figure 5-35 illustrates the rates of hospitalization coded by external cause of injury for active duty Air Force personnel for CY 1980-1994. The rates show a gradual decrease that essentially mirrors the trend of total hospitalizations seen in Figure 5-33. The overall rate decreased 43% from 21 per 1,000 personnel in CY 1980 to 12 per 1,000 personnel in CY 1994. These rates are higher than for the injury principal diagnosis group alone because injuries with an external cause code may fall under other principal diagnosis groups. For example, late, recurrent, or chronic effects of injuries are typically coded under the musculoskeletal system principal diagnosis group.

Worksheet Data for Figure 5-35

Air Force - Rates of Hospitalization by External Cause of Injury by Calendar Year*														
1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
21	20	19	19	16	16	15	15	14	12	12	11	11	12	12

* Rates per 1,000 personnel.

Air Force - Rates of Hospitalization Coded by External Cause of Injury* for Active Duty Personnel, CY 1980-1994



* NATO Standard Agreement (STANAG) codes.

Source: Inpatient database (numerator) and military personnel extract (denominator), Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

Figure 5-35

Figure 5-36 illustrates the rates of hospitalization for the top 10 external causes of injury for active duty Air Force personnel for CY 1980-1994.

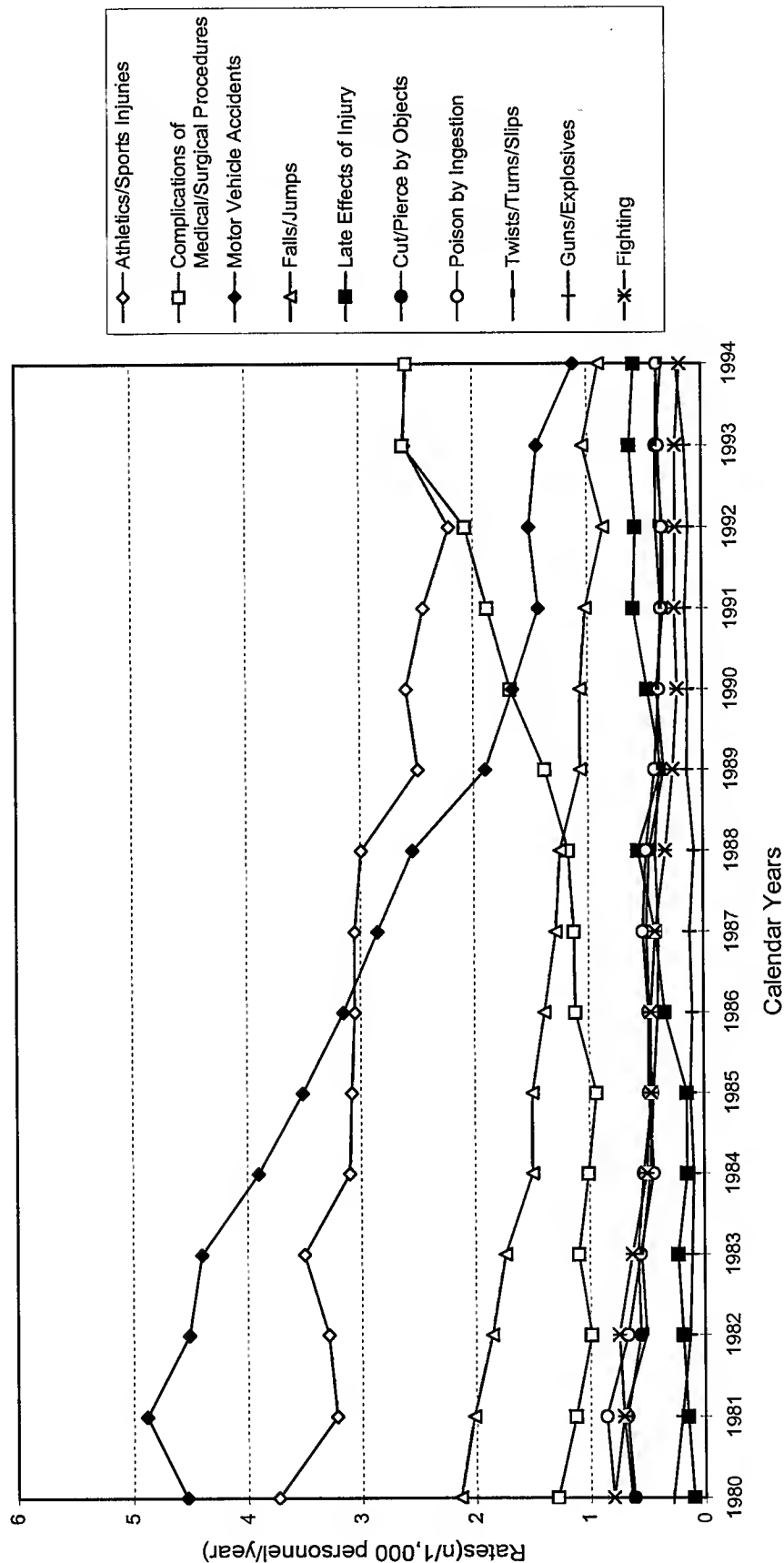
- Athletics and sports decreased 30% from 3.7 per 1,000 personnel for CY 1980 to 2.6 per 1,000 personnel for CY 1994.
- Complications of medical or surgical procedures increased 50% from 1.3 per 1,000 personnel in CY 1980 to 2.6 per 1,000 personnel in CY 1994.
- Motor vehicle accidents decreased 76% from 4.5 per 1,000 in CY 1980 to 1.1 per 1,000 personnel in CY 1994.
- Falls and jumps decreased 57% from 2.1 per 1,000 personnel in CY 1980 to 0.9 per 1,000 personnel in CY 1994.

Worksheet Data for Figure 5-36

Top 10 External Causes of Injury (Rank Based on 1994 Data)	Air Force - Rates of Hospitalization by External Cause of Injury by Calendar Year*														
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Athletics/Sports	3.7	3.2	3.3	3.5	3.1	3.1	3.1	3.1	3.0	2.5	2.6	2.4	2.2	2.6	2.6
Compl. of Medical/Surgical	1.3	1.1	1.0	1.1	1.0	0.9	1.1	1.1	1.2	1.4	1.7	1.9	2.1	2.6	2.6
Motor Vehicle Accidents	4.5	4.9	4.5	4.4	3.9	3.5	3.2	2.9	2.5	1.9	1.7	1.4	1.5	1.4	1.1
Falls/Jumps	2.1	2.0	1.9	1.7	1.5	1.5	1.4	1.3	1.3	1.1	1.1	1.0	0.9	1.0	0.9
Late Effects of Injury	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.6	0.4	0.5	0.6	0.6	0.6	0.6
Cut/Pierce by Objects	0.6	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.3	0.4	0.3	0.3	0.4	0.4
Poisoning by Ingestion	0.8	0.9	0.7	0.6	0.4	0.5	0.5	0.5	0.5	0.4	0.4	0.7	0.4	0.4	0.4
Twists/Turns/Slips	0.6	0.7	0.5	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.7	0.4	0.4	0.4
Guns/Explosives	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2
Fighting	0.8	0.7	0.8	0.6	0.5	0.5	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2

* Rates per 1,000 personnel.

Air Force - Rates of Hospitalization for the Top 10 External Causes of Injury* for Active Duty Personnel, CY 1980-1994



* NATO Standard Agreement (STANAG) codes.

Source: Inpatient database (numerator) and military personnel extract (denominator), Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

Figure 5-36

Figure 5-37 illustrates the NERs for hospitalizations for the top 10 external causes of injury for active duty Air Force personnel for CY 1980-1994.

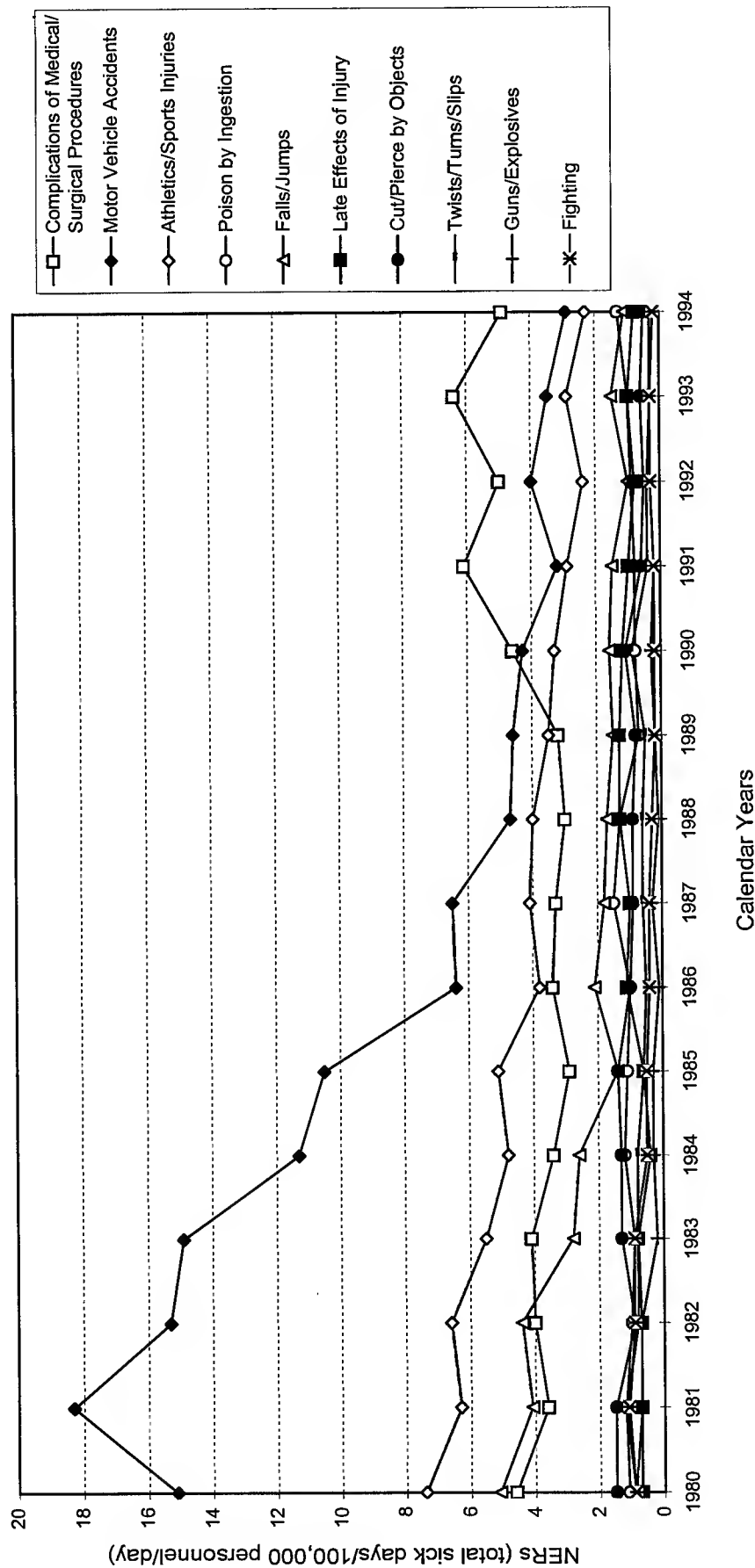
- Motor vehicle accident NERs decreased 84% from a high of 18.3 per 100,000 personnel per day in CY 1981 to 2.9 per 100,000 personnel per day in CY 1994.
- Athletics/sports NERs decreased 69% from 7.4 per 100,000 personnel per day in CY 1980 to 2.3 per 100,000 personnel per day in CY 1994.
- Falls and jumps decreased 78% from 5.1 per 100,000 personnel per day in CY 1980 to 1.1 per 100,000 personnel per day in CY 1994.

Worksheet Data for Figure 5-37

Top 10 External Causes (Rank Based on 1994 Data)	Air Force - Non-Effective Rates* for Hospitalizations Due to Injuries by Calendar Year														
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Motor Vehicle Accidents	15.1	18.3	15.3	14.9	11.3	10.5	6.4	6.5	4.7	4.6	4.3	3.2	4.0	3.5	2.9
Athletics/Sports	7.4	6.3	6.6	5.5	4.8	5.1	3.8	4.1	4.0	3.5	3.3	2.9	2.4	2.9	2.3
Falls/Jumps	5.1	4.1	4.4	2.8	2.6	1.4	2.1	1.8	1.7	1.5	1.6	1.5	1.0	1.5	1.1
Comp. of Medical/Surgical	4.6	3.6	4.0	4.1	3.4	2.9	3.4	3.3	3.0	3.2	4.6	6.1	5.0	6.4	4.9
Cut/Pierce by Object	1.5	1.5	0.9	1.3	1.3	1.4	1.0	0.9	0.9	0.8	1.1	0.6	0.5	0.6	0.5
Poisoning by Ingestion	1.1	1.2	1.0	0.9	1.2	1.1	1.0	1.5	1.3	0.7	0.8	0.8	0.9	1.0	1.3
Twists/Turns/Slips	0.9	1.2	0.8	0.8	0.8	0.6	0.5	0.6	0.6	0.5	0.9	0.4	0.4	0.3	0.3
Guns/Explosives	0.9	0.7	0.7	0.2	0.3	0.3	0.1	0.3	0.1	0.2	0.3	0.2	0.3	0.3	0.2
Fighting	0.9	1.1	0.9	0.9	0.5	0.5	0.4	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.2
Late Effects of Injury	0.7	0.7	0.7	0.8	0.4	0.6	1.1	1.0	1.3	1.3	1.2	1.0	0.8	1.0	0.8

* Rates are days lost per 100,000 personnel per day.

Air Force - Non-Effective Rates for Hospitalizations for the Top 10 External Causes of Injury* for Active Duty Personnel, CY 1980-1994



* NATO Standard Agreement (STANAG) codes.

Source: Inpatient database (numerator) and military personnel extract (denominator), Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force, 1996.

Figure 5-37

Table 5-19 displays the frequency, case rates, and NERs by external causes of injury for hospitalized active duty Air Force men and women for CY 1994.

- The top three hospitalization rates by external cause of injury for men were:
 - Athletics and sports injuries—2.8.
 - Complications of medical or surgical procedures—2.1.
 - Motor vehicle accidents—1.2.
- The top three hospitalization rates by external cause of injury for women were:
 - Complications of medical or surgical procedures—5.2.
 - Athletics and sports injuries—1.3.
 - Motor vehicle accidents—1.1.
- The top three NERs by external cause of injury for men were:
 - Complications of medical or surgical procedures—4.4.
 - Motor vehicle accidents—3.0.
 - Athletics and sports injuries—2.5.
- The top three NERs by external cause of injury for women were:
 - Complications of medical or surgical procedures—7.9.
 - Poisoning by ingestion—3.0.
 - Motor vehicle accidents—2.7.
- Motor vehicle accident rates were similar for men and women.
- Athletics and sport injuries case rates were greater for men as compared to women.
- Motor vehicle accidents and complications of medical or surgical procedures were one of the top three contributors to non-effective days for both men and women.

Table 5-19. Air Force - Frequency (n), Case Rates, and Non-Effective Rates by External Causes of Injury for Hospitalized Active Duty Men and Women, CY 1994

External Causes of Injury	Men			Women			Total		
	n*	Case Rate†	NER‡	n	Case Rate	NER	n	Case Rate	NER
Athletic and Sports Injuries	1,015	2.8	2.5	83	1.3	1.1	1,098	2.6	2.3
Complications of Medical/Surgical Procedures	752	2.1	4.4	342	5.2	7.9	1,094	2.6	4.9
Motor Vehicle Accidents	440	1.2	3.0	74	1.1	2.7	514	1.2	2.9
Falls or Jumps	315	0.9	1.0	68	1.0	1.2	383	0.9	1.1
Late Effects of Injury	203	0.6	0.7	48	0.7	1.4	251	0.6	0.8
Cutting or Piercing Objects	145	0.4	0.5	22	0.3	0.3	167	0.4	0.5
Poisoning by Ingestion	99	0.3	1.0	66	1.0	3.0	165	0.4	1.3
Twisting, Turning, Slipping	130	0.4	0.3	21	0.3	0.3	151	0.4	0.3
Guns, Explosives, and Related Agents	84	0.2	0.2	10	0.2	0.3	94	0.2	0.2
Fighting	66	0.2	0.2	13	0.2	0.1	79	0.2	0.2
Other Specified Environmental Factors	45	0.1	0.1	18	0.3	0.2	63	0.2	0.1
Machinery, Tools, and Other Agents	57	0.2	0.2	2	0	0	59	0.1	0.1
Water and Land Transport	45	0.1	0.2	10	0.2	0.1	55	0.2	0.1
Lifting, Pushing, Pulling	34	0.1	0.1	7	0.1	0.1	41	0.1	0.1

Table 5-19.—Continued

External Causes of Injury	Men			Women			Total		
	n*	Case Rate†	NER‡	n*	Case Rate†	NER‡	n*	Case Rate†	NER‡
Sting or Bite	31	0.1	0.1	3	0.1	0	34	0.1	0.1
Military Air Transport Accidents	31	0.1	0.1	1	0	0	32	0.1	0.1
Fire, Hot, Corrosive	20	0.1	0.1	6	0.1	0.2	26	0.1	0.1
Poison by Inhalation	21	0.1	0	4	0.1	0	25	0.1	0
Excessive Heat	12	0	0	7	0.1	0.1	19	0	0
Advance Syst/Skin Reaction	9	0	0	4	0.1	0	13	0	0
Complications of Prophylactic Inoculations	8	0	0	4	0.1	0	12	0	0
Conventional Weapons Injury	11	0	0	0	0	0	11	0	0
Hanging, Suffocation	8	0	0	0	0	0	8	0	0
Marching or Drilling	5	0	0	0	0	0	5	0	0
Excessive Cold	3	0	0	2	0	0	5	0	0
Drowning or Submersion	2	0	0	0	0	0	2	0	0
Codes Not Specified	105	0.3	0.3	7	0.1	0.1	113	0.3	0.2
Unknown or Unspecified Agents	364	1.0	1.2	51	0.8	1.2	415	1.0	1.2
Totals	4,040	11.3	16.1	867	9.4	20.1	4,907	11.5	16.5

* Frequency = number of hospitalizations.

† Case Rate = number of persons hospitalized per 1,000 personnel per year.

‡ NER = total sick days per 100,000 personnel per day.

Source: Medical Information Systems Division, Directorate of Health Care Support, Office of the Surgeon General, U.S. Air Force.

5-10. Comparison of All Services

The military hospitalization data for each service, presented in paragraphs 5-6 through 5-9, are presented from three perspectives:

- Data reporting among the services is not compatible. The Army and Air Force group hospitalization codes by principal diagnosis. The Navy and Marine Corps group hospitalization codes by major diagnostic categories. Table 5-20 displays how the distribution of hospitalizations from the two reporting systems cannot be compared.
- Using the Defense Medical Epidemiology Database (DMED) for Navy and Marine Corps data, each service's distribution of hospitalizations by ICD-9 based Principal Diagnosis Group for 1994 is compared in Table 5-21.
- Each service's unadjusted hospitalization rates for 1989-1994 are compared in Table 5-22.

Table 5-20. Distribution of Hospitalizations for Active Duty Personnel, 1994—An Illustration of the Differences in Hospitalization Coding Schemes Among Services

Table 3-20. Distribution of Hospitalizations for Acute Care by Personnel, 1994-1997: Identification of the Differences in Reporting											
PDG* or MDC†	Codes		Distribution (%) of Top 10 Hospitalizations For Each Service								Conclusions
	ICD-9	MDC	Army (CY94)* (n = 84,086)		Navy (FY94)† (n = 32,021)		Marine Corps (FY94)† (n = 10,992)		Air Force (CY94)* (n = 42,479)		
			%	Rank	%	Rank	%	Rank	%	Rank	
Musculoskeletal System	710-739	8	18%	1	22%	1	28%	1	14%	2	Data Reporting <ul style="list-style-type: none">At the outset of data collection, the services used non-uniform reporting methods that resulted in noncomparable data.The Army and Air Force grouped hospitalization codes by principal diagnosis groups.The Navy and Marine Corps grouped hospitalization codes by major diagnostic categories.To illustrate data comparability among services, CY94 data were requested from DMED—a resource not available at the outset of data collection efforts. See Table 5-21. Musculoskeletal System <ul style="list-style-type: none">Most injuries for the Navy and Marine Corps are in the musculoskeletal system category.
Digestive System	520-579	6	12%	2	12%	3	12%	2	22%	1	
Injury	800-999	21	10%	3	2%‡	—	3%‡	—	8%	4	
Pregnancy	630-676	14	9%	4	13%	2	5%	7	13%	3	
Respiratory System	460-519	4	9%	5	—	—	4%	8	6%	7	
Mental Disorders	290-319	19	8%	6	8%	4	7%	5	6%	6	
Genitourinary System	580-629	—	5%	7	—	—	—	—	7%	5	
Infectious & Parasitic	001-139	—	5%	8	—	—	—	—	—	—	
V Codes§	V01-V82	—	4%	9	—	—	—	—	—	—	
Ill-Defined Conditions	780-799	—	4%	10	—	—	—	—	3%	8	
Neoplasms	140-239	17	—	—	—	—	—	—	3%	—	
Skin & Breast	680-709	9	—	—	5%	5	6%	6	—	—	
Circulatory System	390-459	5	—	—	4%	7	—	—	3%	10	
Nervous System	320-389	1	—	—	3%	8	3%	10	3%	9	
Ear, Nose, Mouth, & Throat	—	3	—	—	8%	4	7%	4	—	—	
Alcohol & Drugs	—	20	—	—	4%	6	9%	3	—	—	
Male Reproductive System	—	12	—	—	—	—	3%	9	—	—	
Female Reproductive System	—	13	—	—	4%	9	—	—	—	—	
Other (groups less than 3% each)	—	—	16%	—	17%	—	16%	—	12%	—	

* Army and Air Force hospitalizations by principal diagnosis group. † Navy and Marine Corps hospitalizations by major diagnostic categories.

‡ Not in top 10, but added for completion of injury picture.

§ Circumstances recorded as diagnoses or problems, but not classified as a disease, injury, or E code.

Table 5-21. Distribution of Hospitalizations by ICD-9 Based Principal Diagnosis Group for Active Duty Personnel, 1994—Comparing the Services Using Standardized Data

PDG		ICD-9 Codes	Distribution (%) of Top 10 Hospitalizations For Each Service										Conclusions
			Army (CY94) (n = 84,086)		Navy (CY94)* (n = 38,626)		Marine Corps (CY94)* (n = 13,509)		Air Force (CY94) (n = 42,479)				
			%	Rank	%	Rank	%	Rank	%	Rank			
Musculoskeletal System		710-739	18%	1	17%	1	21%	1	14%	2	Musculoskeletal System <ul style="list-style-type: none">Musculoskeletal system diseases, which are largely injury-related conditions, are the leading cause of hospitalization for the Army, Navy, and Marine Corps, but are the second leading cause of hospitalization for the Air Force. Injury <ul style="list-style-type: none">The injury category was the third through the fifth highest ranking cause of hospitalization across the services. Musculoskeletal System and Injury <ul style="list-style-type: none">The combined musculoskeletal system and injury categories range from 22% of all hospitalizations for the Air Force to 35% of all hospitalizations for the Marine Corps. Digestive System <ul style="list-style-type: none">Digestive system diseases were the leading cause of hospitalization for the Air Force (22%) and second, third, or fourth for the Army (12%), Navy (12%), and Marine Corps (11%). Mental Disorder <ul style="list-style-type: none">Hospitalizations due to mental disorders range from 6% for the Air Force to 15% for the Marine Corps.		
Digestive System		520-579	12%	2	12%	3	11%	4	22%	1			
Injury		800-999	10%	3	9%	5	14%	3	8%	4			
Pregnancy		630-676	9%	4	12%	4	5%	6	13%	3			
Respiratory System		460-519	9%	5	7%	6	8%	5	6%	7			
Mental Disorders		290-319	8%	6	12%	2	15%	2	6%	6			
Genitourinary System		580-629	5%	7	6%	7	5%	7	7%	5			
Infectious & Parasitic		001-139	5%	8	—	—	—	—	—	—			
V Codes†		V01-V82	4%	9	5%	8	4%	8	—	—			
Ill-Defined Conditions		780-799	4%	10	4%	9	3%	10	3%	8			
Skin & Breast		680-709	—	—	—	—	—	—	—	—			
Circulatory System		390-459	—	—	—	—	3%	9	3%	10			
Nervous System		320-389	—	—	4%	10	—	—	3%	9			
Neoplasms		140-239	—	—	—	—	—	—	3%	—			
Other (PDGs <3% each) Endocrine, Nutritional, & Metabolic; Blood & Blood Forming Organs; Congenital Anomalies; Perinatal Period Conditions		240-279 280-289 740-759 760-779	16%	—	13%	—	12%	—	12%	—			

* To illustrate data comparability among the services, CY94 data were obtained from DMED—a resource not available at the outset of data collection efforts.

† Circumstances recorded as diagnoses or problems, but not classified as a disease, injury, or E code.

Table 5-22. Unadjusted Rates of Hospitalization for Active Duty Personnel, 1989-1994—A Comparison of All Services

Years	Rates Per 1,000/Personnel/Year				Conclusions
	Army (CY)	Navy (FY)	Marine Corps (FY)	Air Force (CY)	
1989	151	95	83	106	From 1989 to 1994, the hospitalization rates for the Navy and Marine Corps declined 27% and 24%, respectively, while the rates for the Army and Air Force remained relatively stable.
1990	145	93	83	103	
1991	142	86	77	101	
1992	143	83	79	97	
1993	140	77	74	110	
1994	153	71	61	100	

Supplement A. Army - Operations Desert Shield and Storm, Injury Hospitalizations

With the increased number of military deployments in the post-Cold War era, sound epidemiological data are essential for understanding the health of military personnel during such operations. The Operations Desert Shield and Storm hospitalization data from southwest Asia for 1 August 1990 - 31 July 1991 are presented in three parts:

- Magnitude of the Injury Problem Relative to Other Causes of Hospitalization.
 - The distribution of selected hospitalization diagnoses by principal diagnosis group is displayed in Figure 5A-1.
 - The distribution of leading nonbattle injury hospitalizations is displayed in Figure 5A-2.
 - The distribution of sports and athletic injury diagnoses for hospitalizations is displayed in Figure 5A-3.
- Trends of Operations Desert Shield and Storm Nonbattle Injury Hospitalizations Over Time.
 - The rates of nonbattle injury hospitalization by month are displayed in Figure 5A-4.
- Hospitalizations by Causes of Injury.
 - The leading causes of injury hospitalizations are displayed in Table 5A-1.

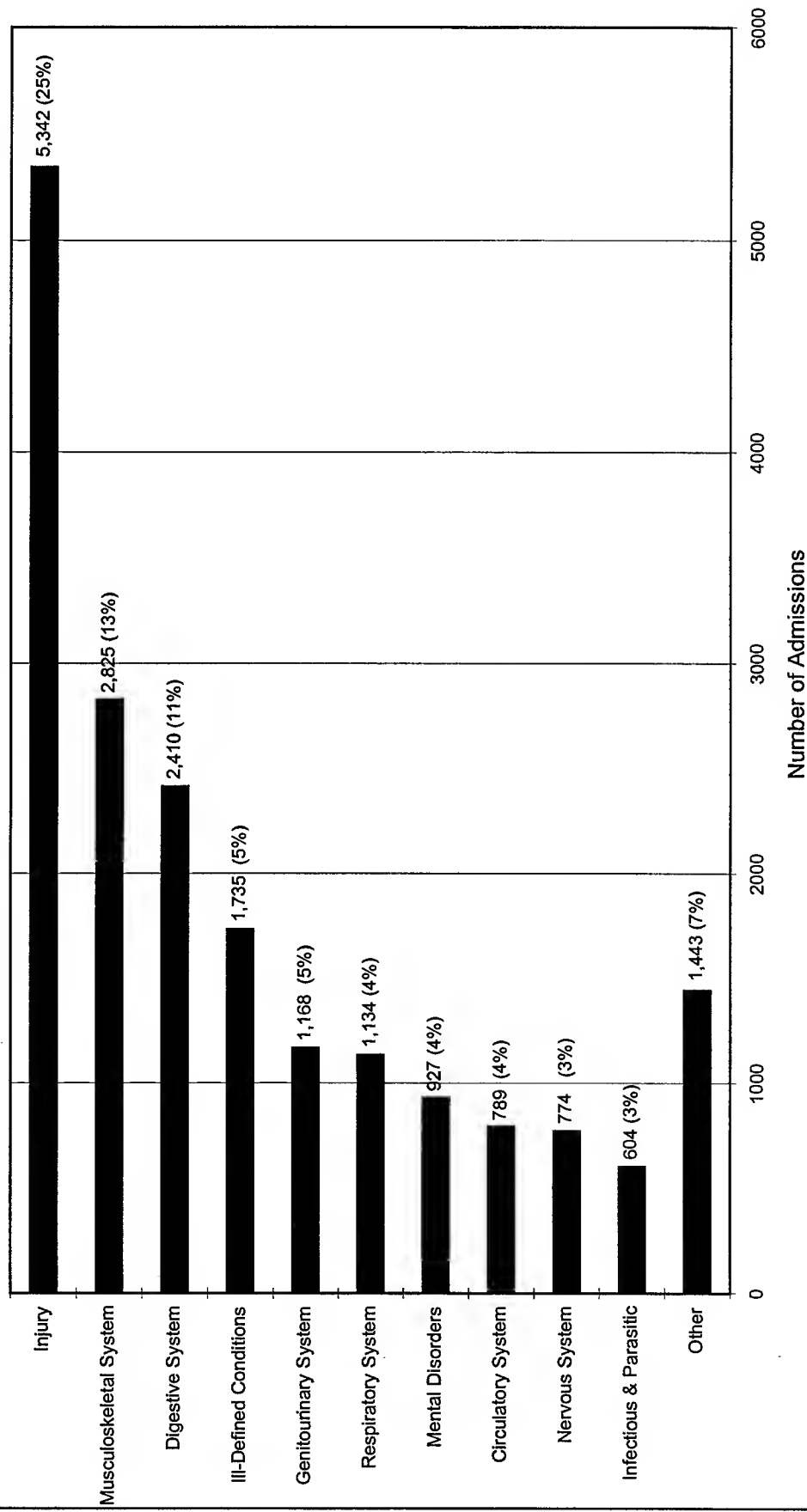
Magnitude of the Injury Problem Relative to Other Causes of Hospitalization.

Figure 5A-1 illustrates selected nonbattle hospitalization diagnoses by principal diagnosis group during Operations Desert Shield and Storm, 1 August 1990 - 31 July 1991. A total of 21,655 personnel were admitted to Army hospitals during Operations Desert Shield and Storm. The top five diagnoses were:

- Acute nonbattle injuries (ICD-9 codes 800-999)—25% (5,342).
- Musculoskeletal system (ICD-9 codes 710-739)—13% (2,825).
- Digestive system (ICD-9 codes 5200-579)—11% (2,410).
- Ill-defined conditions (ICD-9 codes 7890-799)—8% (1,735).
- Genitourinary system (ICD-9 codes 580-629)—5% (1,168).

There were only 956 battle-related admissions, less the 5% of all in-theater hospitalizations.

Army - Operations Desert Shield and Storm, Top 10 Nonbattle Hospitalization Diagnoses by Principal Diagnosis Group, 1 August 1990 - 31 July 1991



n = 21,655.

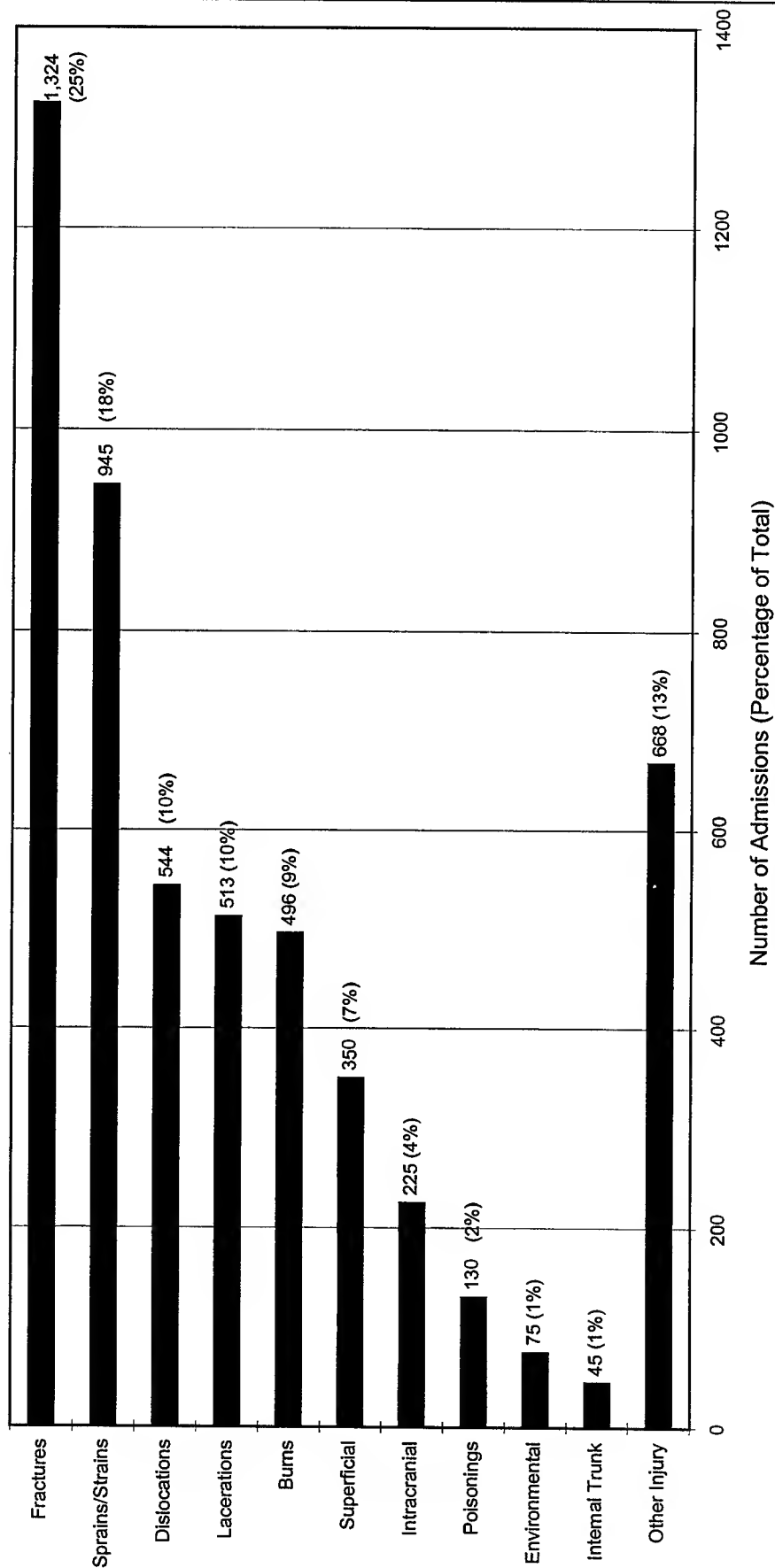
Source: Adapted from the Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 5A-1

Figure 5A-2 illustrates the leading nonbattle injury diagnoses resulting in hospitalizations during Operations Desert Shield and Storm, 1 August 1990 - 31 July 1991. A total of 5,315 personnel were admitted to Army hospitals for nonbattle injuries. The top five causes of hospitalization were:

- Fractures—25% (1,324).
- Sprains/strains—18% (945).
- Dislocations—10% (544).
- Lacerations—10% (513).
- Burns—9% (496).

Army - Operations Desert Shield and Storm, Leading Nonbattle Injury Hospitalizations, 1 August 1990 - 31 July 1991



n = 5,315.

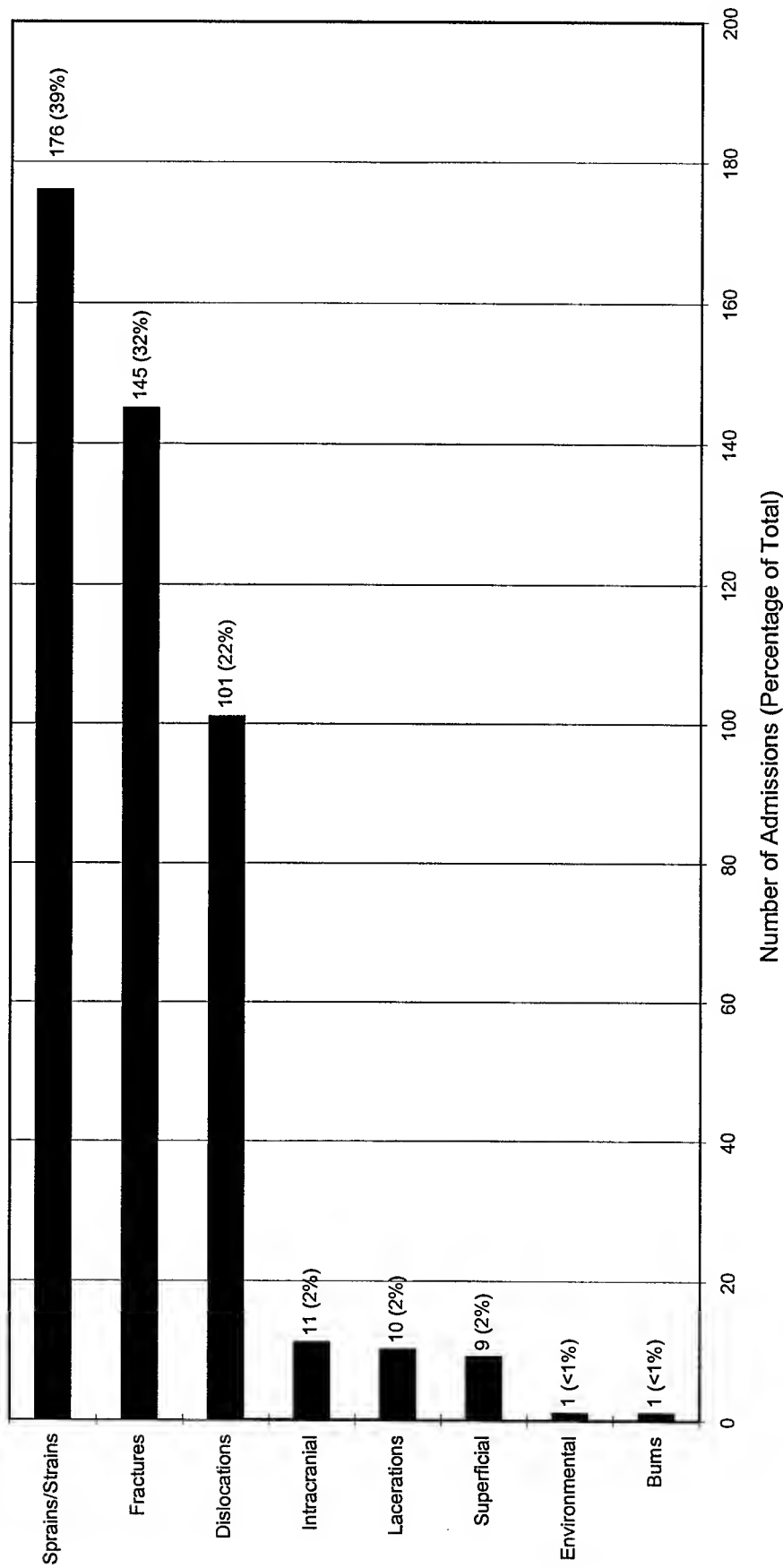
Source: Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 5A-2

Figure 5A-3 illustrates the hospitalizations for sports and athletic injuries during Operations Desert Shield and Storm, 1 August 1990 - 31 July 1991. A total of 454 personnel were admitted to Army hospitals for sports and athletic injuries. The top five causes of hospitalization were:

- Sprains/strains—39% (176).
- Fractures—32% (145).
- Dislocations—22% (101).
- Intracranial—2% (11).
- Lacerations—2% (10).

Army - Operations Desert Shield and Storm, Hospitalizations for Sports and Athletic Injuries, 1 August 1990 - 31 July 1991

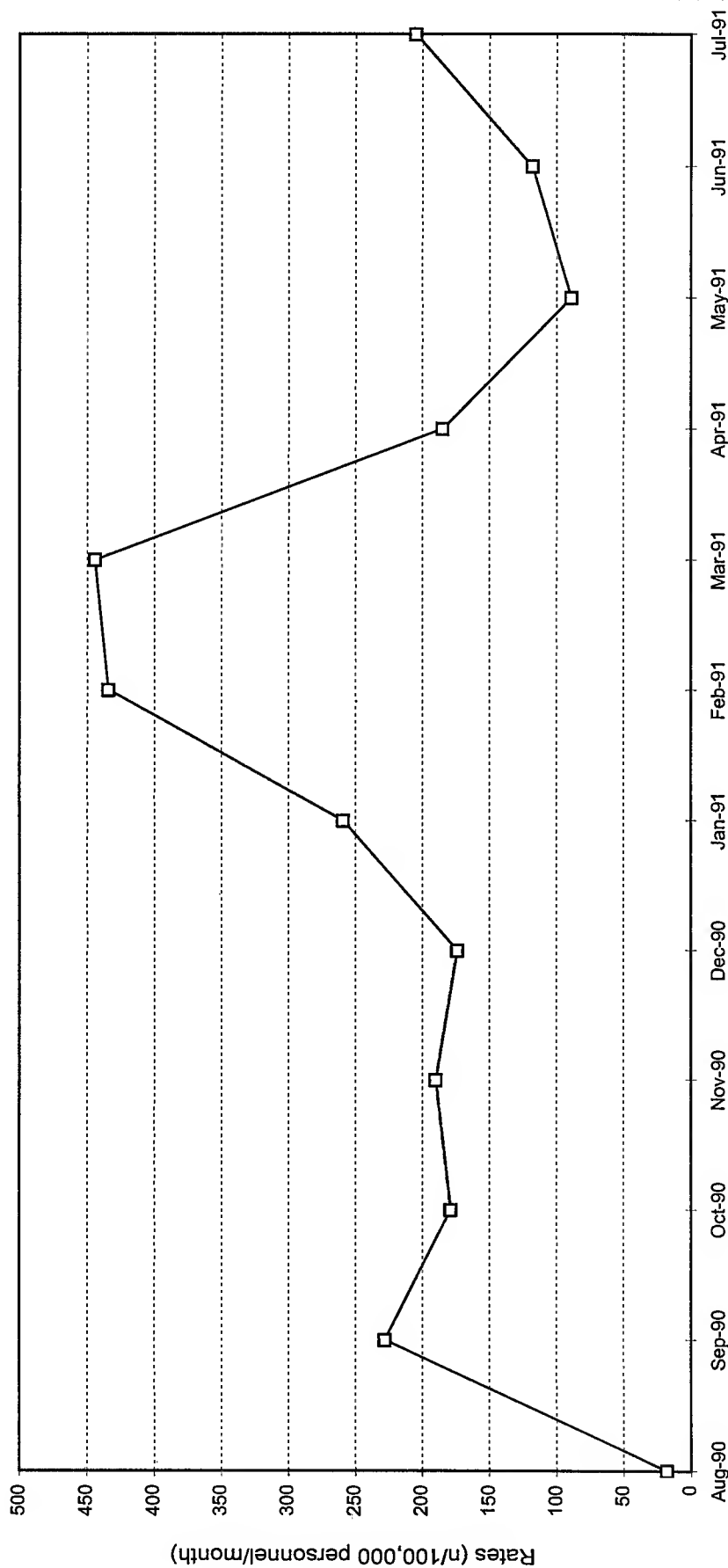


n = 454.

Source: Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 5A-3

Army - Operations Desert Shield and Storm, Rates of Nonbattle Injury Hospitalization by Month, 1 August 1990 - 31 July 1991



Source: Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Figure 5A-4

Hospitalizations by Causes of Injury.

Table 5A-1 illustrates the six leading causes of injury hospitalizations during Operations Desert Shield and Storm, 1 August 1990-31 July 1991.

Table 5A-1. Army - Leading Causes of Injury Hospitalizations During Operations Desert Shield and Storm, 1 August 1990 - 31 July 1991

Causes of Injury (Selected STANAG Codes)*	Number	% of Injuries with Cause Code†	Rate‡
Motor Vehicle Accidents	566	19%	4.0
Falls	559	19%	4.0
Sports and Athletics	512	18%	3.6
Machinery and Tools	398	4%	2.8
Other Land Transport	126	4%	0.9
Weapons	113	4%	0.8

* The U.S. military services use standard NATO cause codes (STANAG codes) rather than ICD-9 E-codes.

† There were a total of 5,342 admissions for acute nonbattle injuries. Only about 50% of these (2,664) received an ICD-9 E-code designating the specific cause of injury.

‡ Rate per 1,000 personnel per year.

Source: Armed Forces Epidemiological Board, *Injuries in the Military: A Hidden Epidemic*, 1996.

Supplement B. Navy - Naval Health Research Center, Injury Hospitalizations Among Enlisted Personnel

The NHRC provided data on enlisted personnel for CY 1980-1992 using principal diagnosis codes. These data are provided as a supplement to that provided by NMIMC, which used major diagnostic categories to describe hospitalizations for the Navy population.

The Naval Health Research Center hospitalization data are presented in two parts:

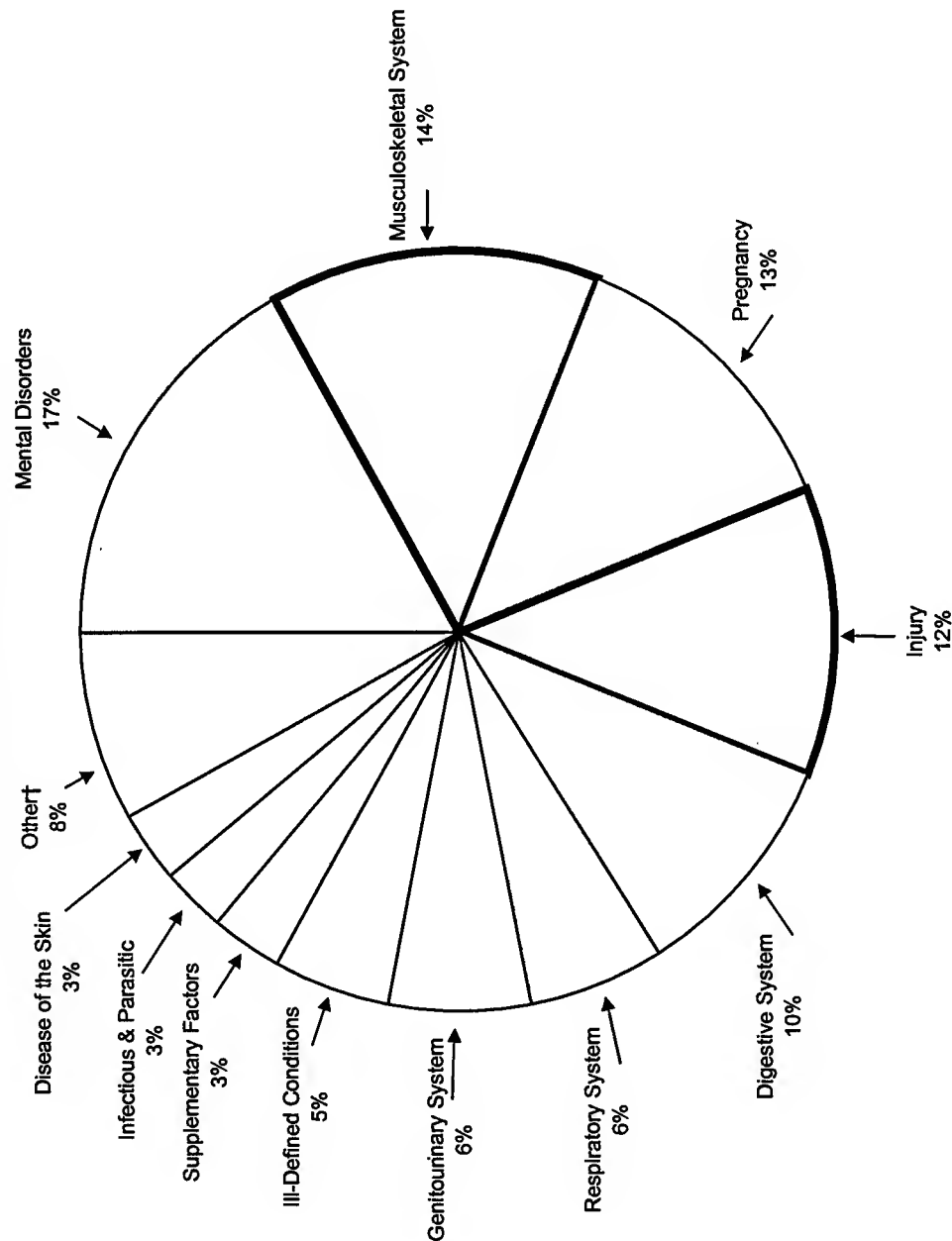
- Magnitude of the Injury Problem Relative to Other Causes of Hospitalization.
 - The distribution of hospitalizations for enlisted personnel by principal diagnosis group for CY 1992 is displayed in Figure 5B-1.
- Trends of Navy Injury-Related Hospitalizations Relative to Other Causes Over Time.
 - The rates of hospitalization by year for CY 1980-1992 are displayed in Figure 5B-2.
 - The rates of hospitalization for the top 10 principal diagnosis groups for CY 1980-1992 are displayed in Figure 5B-3.
 - The rates of musculoskeletal disease and injury for men and women for CY 1980-1992 are displayed in Figure 5B-4.

Magnitude of the Injury Problem Relative to Other Hospitalization Diagnoses

Figure 5B-1 illustrates the distribution of 34,982 hospitalizations by principal diagnosis group for enlisted Navy personnel for CY 1992. The top five contributors to hospitalization were:

- Mental disorders (ICD-9 codes 290-319)—17%.
- Musculoskeletal system (ICD-9 codes 710-739)—14%.
- Pregnancy (ICD-9 codes 630-676)—13%.
- Injury (ICD-9 codes 800-999)—12%.
- Digestive system (ICD-9 codes 520-579)—10%.

Navy - Distribution (%) of Hospitalizations for Enlisted Personnel by Principal Diagnosis Group,* CY 1992



n = 34,982.

* Principal diagnosis groups based on the *International Classification of Diseases*, 9th edition.

† Other includes diagnosis groups accounting for less than 3%, of total hospitalization each.

Source: Naval Health Research Center, Navy Hospital Records Database, 1993.

Figure 5B-1

Trends of Navy Injury-Related Hospitalizations Over Time

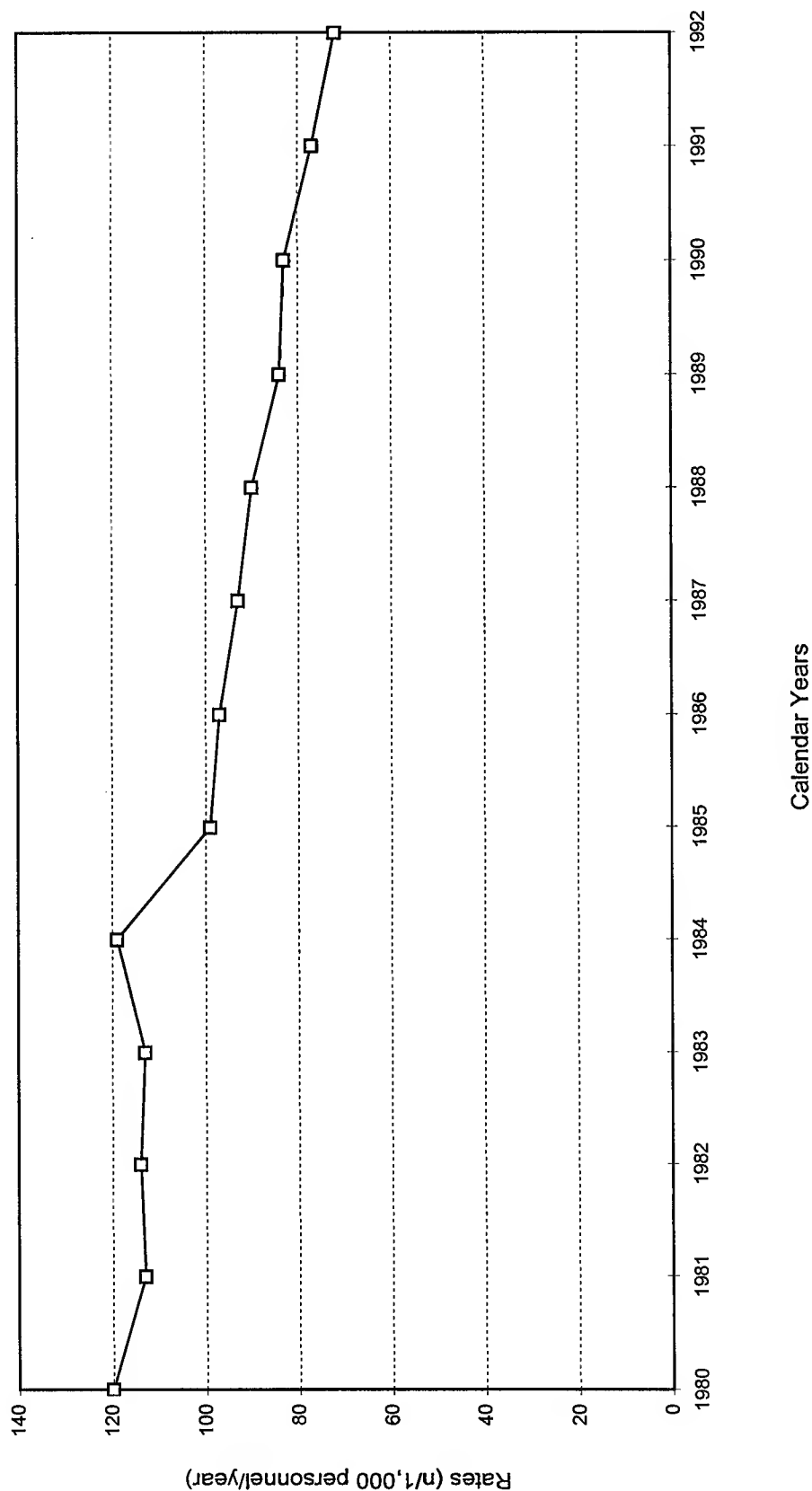
Figure 5B-2 illustrates the rates of hospitalization by year for enlisted Navy personnel for CY 1980-1992. The overall rate decreased 40% from 120 per 1,000 personnel in CY 1980 to 72 per 1,000 personnel in CY 1992.

Worksheet Data for Figure 5B-2

Navy - Rates of Hospitalization by Calendar Year*													
1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	
120	113	114	113	119	99	97	93	90	84	83	77	72	

* Rates per 1,000 personnel.

Navy - Rates of Hospitalization for Enlisted Personnel by Year, CY 1980-1992



Source: Naval Health Research Center, Navy Hospital Records Database, 1993.

Figure 5B-2

Figure 5B-3 illustrates the rates of hospitalization for the top 10 principal diagnosis groups for Navy enlisted personnel for CY 1980-1992.

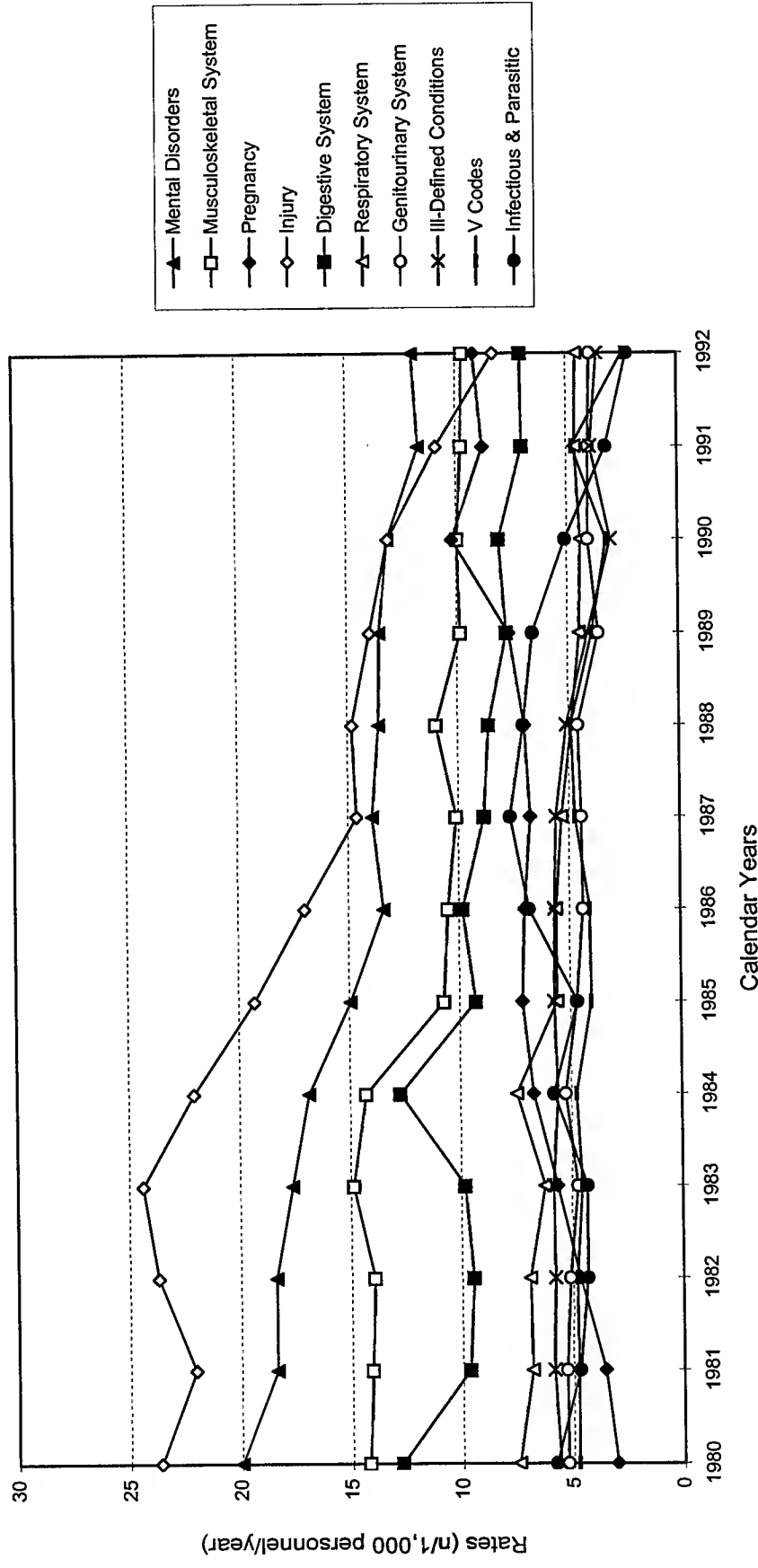
- From CY 1980-1992, injury and musculoskeletal system diseases remained in the top four hospital diagnoses.
- Through the 1980s, injury was consistently the leading cause of hospitalization.
- Through the 1980s, musculoskeletal system diseases were the third leading cause of hospitalizations.
- In CY 1992, musculoskeletal system diseases were the second leading cause of hospitalization (9.7%), having fallen 32% from CY 1980 rates.
- From CY 1980-1992, hospitalizations due to musculoskeletal system diseases decreased 32%.
- From CY 1980-1992, injury hospitalization rates decreased 65%.

Worksheet Data for Figure 5B-3

Top 10 Principal Diagnosis Groups (Rank Based on 1992 Data)		ICD-9 Codes	Navy - Rates of Hospitalization by Calendar Year*												
			1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Mental Disorders		290-319	20.0	18.4	18.4	17.6	16.9	14.9	13.4	13.9	13.6	13.5	13.1	11.7	12.0
Musculoskeletal System		710-739	14.2	14.1	13.9	14.9	14.3	10.7	10.5	10.1	11.0	9.9	10.0	9.8	9.7
Pregnancy		630-676	3.0	3.6	4.7	5.7	6.7	7.2	7.0	6.8	7.0	7.7	10.2	8.8	9.2
Injury		800-999	23.6	22.0	23.7	24.4	22.1	19.3	17.0	14.6	14.8	14.0	13.1	10.9	8.3
Digestive System		520-579	12.7	9.7	9.5	9.8	12.7	9.3	9.8	8.9	8.6	7.8	8.1	7.0	7.1
Respiratory System		460-519	7.5	6.8	6.9	6.2	7.5	5.6	5.6	5.4	4.9	4.5	4.4	4.6	4.6
Genitourinary System		580-629	5.3	5.3	5.1	4.7	5.3	4.7	4.4	4.5	4.6	3.6	4.1	4.0	3.9
Ill-Defined Conditions		780-799	5.6	5.9	5.8	5.8	5.6	5.7	5.7	5.6	5.1	4.1	3.1	3.9	3.6
V Codes		V01-V82	4.8	4.8	4.8	4.5	4.8	4.1	4.1	4.7	4.9	3.9	3.2	4.8	2.5
Infectious & Parasitic		001-139	5.8	4.7	4.3	4.3	5.8	4.7	6.8	7.7	7.1	6.6	5.1	3.2	2.3

* Rates per 1,000 personnel.

Navy - Rates of Hospitalization for the Top 10 Principal Diagnosis Groups* for Enlisted Personnel, CY 1980-1992



* Principal diagnosis groups from the *International Classification of Diseases*, 9th Edition.

Source: Naval Health Research Center, Navy Hospital Records Database, 1993.

Figure 5B-3

Figure 5B-4 illustrates the rates of hospitalization for musculoskeletal system and injury principal diagnosis groups for male and female Navy enlisted personnel for CY 1980-1992.

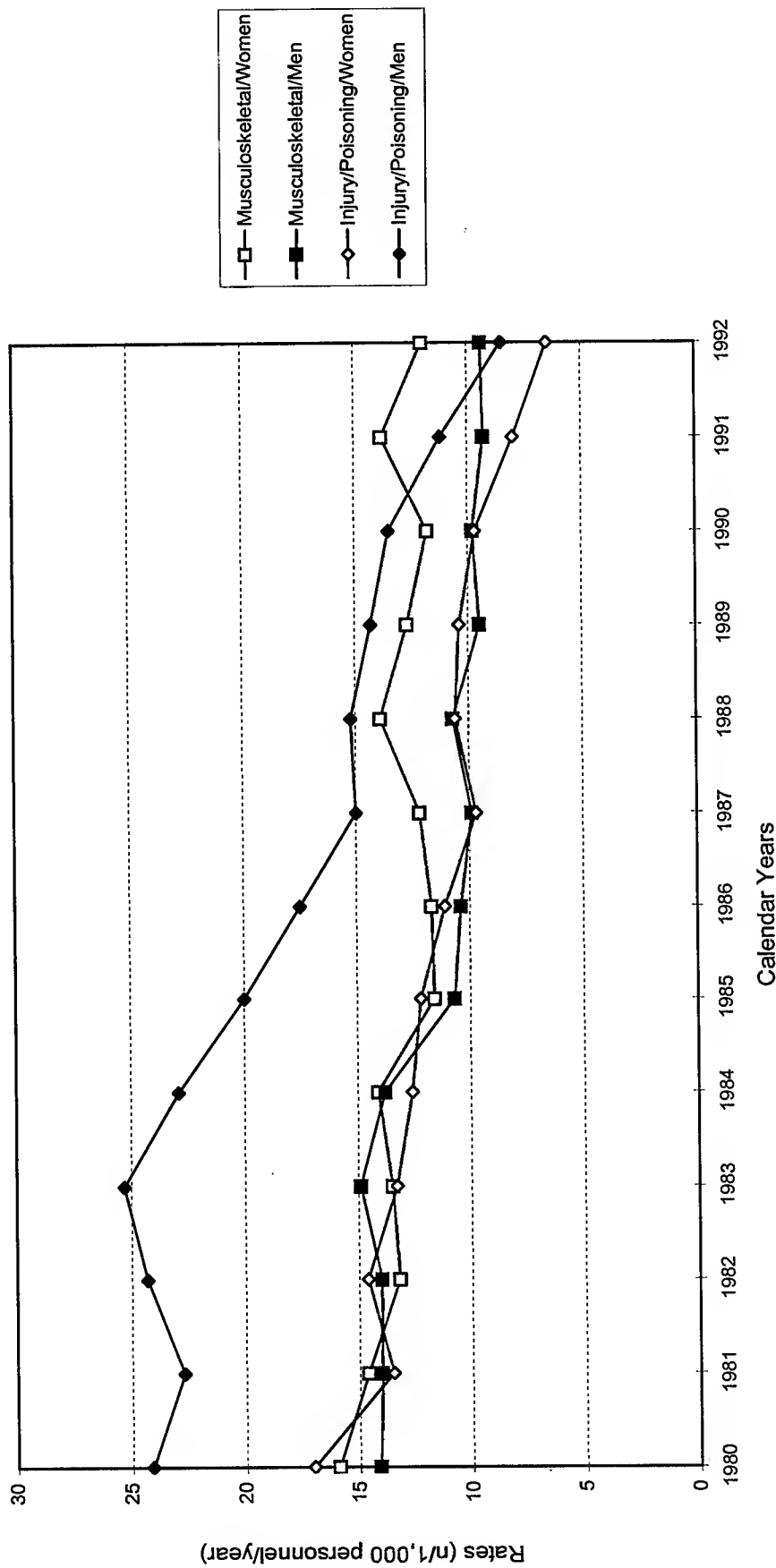
- Musculoskeletal system hospitalization rates for women decreased 25% from 15.9 per 1,000 personnel in CY 1980 to 12.0 per 1,000 personnel in CY 1992.
- Musculoskeletal system hospitalization rates for men decreased 33% from 14.1 per 1,000 personnel in CY 1980 to 9.4 per 1,000 personnel in CY 1992.
- Injury hospitalization rates for women decreased 68% from 17.0 per 1,000 personnel in CY 1980 to 6.5 per 1,000 personnel in CY 1992.
- Injury hospitalization rates for men decreased 65% from 24.1 per 1,000 personnel in CY 1980 to 8.5 per 1,000 personnel in CY 1992.

Worksheet Data for Figure 5B-4

Principal Diagnosis Groups	Navy - Rates of Hospitalization by Calendar Year*												
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Musculoskeletal System—Women	15.9	14.6	13.2	13.5	14.1	11.6	11.7	12.2	13.9	12.7	11.8	13.8	12.0
Musculoskeletal System—Men	14.1	14.0	14.0	14.9	13.8	10.7	10.4	9.9	10.7	9.5	9.8	9.3	9.4
Injury—Women	17.0	13.5	14.6	13.3	12.6	12.2	11.1	9.7	10.6	10.4	9.7	8.0	6.5
Injury—Men	24.1	22.7	24.3	25.3	22.9	20.0	17.5	15.0	15.2	14.3	13.5	11.2	8.5

* Rates per 1,000 personnel.

Navy - Rates of Hospitalization for Musculoskeletal System and Injury Principal Diagnosis Groups* for Male and Female Enlisted Personnel, CY 1980-1992



* Principal diagnosis groups from the *International Classification of Diseases, 9th Edition*.

Source: Naval Health Research Center, Navy Hospital Records Database, 1993.

Figure 5B-4

CHAPTER 6

INJURIES TREATED IN OUTPATIENT CLINICS: SURVEYS AND RESEARCH DATA

Bruce H. Jones, MD, MPH, Richard A. Shaffer, MD, and Michael R. Snedecor, MD, MPH

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Section I. Description of Survey and Research Efforts

6-1. Introduction

Potential databases for injury research include hospitalization and outpatient surveillance databases, data from cohort studies, and morbidity reporting. Of these, the hospitalization databases have been the most heavily utilized. Data include patient demographics, duty status, outcome, detailed cause and nature of injury codes (ICD9-CM, up to 8 diagnosis fields and 8 procedures), residual disability (about 300 codes) and a service-specific code for military occupation (about 1200 codes). A major strength of military hospital discharge data is the inclusion of the Social Security Number, making it possible to link information between databases and across multiple admissions for the same injury episode.

Although the hospital discharge databases offer a tremendous potential for the study of injury, the majority of injuries do not require hospitalization. A more accurate approximation of the scope and magnitude of injuries requires comprehensive outpatient surveillance. An outpatient database could also be utilized to determine outpatient disease rates, identify risk factors, perform cost-benefit analyses, and design preventive interventions. An outpatient surveillance system was developed at the Naval Health Research Center for the purpose of supporting epidemiological research in musculoskeletal injuries. This PC-based software application contains information regarding personal demographics, medical presentation, diagnoses, and disposition and has been utilized to develop and evaluate preventive interventions. The system was implemented in several Navy and Marine Corps training sites since 1994, but has since been replaced at most sites with the Ambulatory Data System (ADS).

The majority of injuries in the military do not result in death or require hospitalization. As a consequence, an accurate approximation of the scope and magnitude of injuries requires comprehensive outpatient surveillance. Numerous field studies have been conducted over the years, the purpose of which has been to understand and define injury risk factors or test interventions. These studies have served as the model for field injury research.

For some time, both the Army and Navy have maintained research databases that collect and manage the following information on injury visits to outpatient clinics:

- Types of injuries.
- Severity of injuries.
- Risk factors.

These research databases provide invaluable data for the understanding of the extent of the injury problem and the design of effective interventions to prevent injuries. The databases discussed in this chapter are maintained at the U.S. Army Research Institute of Environmental Medicine (USARIEM) in Natick, Massachusetts, and the Naval Health Research Center (NHRC) in San Diego, California.

In addition to these service-specific research databases, tri-service outpatient data became available for routine surveillance in December 1997. This system, called the ADS, captures patient data on all outpatient visits in DoD facilities worldwide. The system provides access to automated outpatient diagnosis and treatment information. Outpatient injury and disease data are now integrated with personnel data for all three services by the Army Medical Surveillance Activity (AMSA).

6-2. Mission

The mission of the scientific organizations that maintain these databases is to operate their respective outpatient injury research programs in support of DoD and the respective military service medical departments. This information is necessary to prioritize and structure prevention strategies and to inform leaders and trainers, among others.

6-3. Purpose

The primary purpose of the outpatient injury research databases is to address specific questions regarding injury incidence and risk factors to determine how to prevent losses of manpower due to injury.

6-4. Authority

- **USARIEM.** By Section 6, General Order No. 33, Department of the Army, 20 September 1961, and General Order No. 40, Office of The Surgeon General, 1 December 1961, USARIEM was established a Class II medical activity.
- **NHRC.** Originally designated the U.S. Navy Medical Neuropsychiatric Research Unit, by authority of the Chief of Naval Operations, OPNAVNOTE 5450 Ser 09B33/4248 dated 5 August 1974, the unit was redesignated as the NHRC effective 1 September 1974.

Section II. Epidemiology of Injuries and Risk Factors from Medical Research

6-5. Army

The Army data are presented in five parts:

- Incidence of injury is discussed on pages 6-7 through 6-11.
- Rates of injury vs. illness are discussed on pages 6-12 and 6-13.
- Distribution of injury types is discussed on pages 6-14 through 6-17.
- Risk factors are discussed on pages 6-18 through 6-49.
- Multiple risk factors are discussed on pages 6-50 through 6-55.

Incidence of Injury.

An *injury*, as defined in this chapter, is dermatologic or musculoskeletal damage resulting from an external force of repetitive or traumatic nature.

- *Overuse injury* results from tissue damage due to repetitive, cumulative micro-trauma (e.g., tendinitis, stress fractures, patellofemoral syndrome). Overuse injuries account for almost 75% of all injuries among trainees during basic training.
- *Traumatic injury* results from tissue damage due to sudden, overload trauma (e.g., sprains, fractures, contusions, dislocations, lacerations). Traumatic injuries account for approximately 25% of all injuries among trainees during basic training.
- *Stress fracture* results from bone injury due to repetitive loading (overuse such as marching or running). Diagnosis is based on clinical findings plus a positive x-ray or a positive bone scan (if available). Stress fractures are of interest to the military since there are high rates in basic training and other vigorously active populations, resulting in a substantial loss of training time.

Over 80% of military training injuries involve the lower extremities; upper extremity injuries account for less than 20% of all injuries.

Table 6-1 displays the incidence of injuries among men and women during Army basic training in 1980, 1983, 1984, 1988, and 1995.

- The incidence of injuries among men ranged from a low of 23% in 1983 to a high of 27% in both 1984 and 1988.
- The incidence of injuries among women ranged from a low of 42% in 1983 to a high of 67% in 1995.
- Incidence of injuries among women during basic training tended to be about twice that of men.

Table 6-1. Army - Incidence (%) of Injuries Among Men and Women in Basic Training*

Year	Men		Women		Rate Ratio† (Women/Men)
	n	(%)	n	(%)	
1980 ¹	770	26%	347	54%	2.1
1983 ²	3,437	23%	767	42%	1.8
1984 ³	124	27%	186	51%	1.9
1988 ⁴	509	27%	352	57%	2.1
1995 ⁵	—	—	174	67%	—

* 8 weeks, Fort Jackson, SC.

† Rate ratio = injury rate/illness rate.

1. Kowal, D.M. "Nature and Causes of Injuries to Women Resulting from an Endurance Training Program." *American Journal of Sports Medicine* 8(4): 265-269, 1980.
2. Bense, C.K., and R.N. Kish. "Lower Extremity Disorders Among Men and Women in Army Basic Training and the Effects of Two Types of Boots." U.S. Army Natick Research and Development Laboratories, Natick, MA. Natick Technical Report: TR 83/026, January 1983.
3. Jones, B.H., M.W. Bovee, and J.J. Knapik. "Associations Among Body Composition, Physical Fitness, and Injury in Men and Women Army Trainees." In *Body Composition and Physical Performance*, National Academy Press, Washington, DC, 1992, pp. 141-173.
4. Bell, N.S., T.W. Mangione, D. Hemenway, P.J. Amoroso, and B. H. Jones. Injury Etiology and Prevention Selected Topics: High Injury Rates Among Female Trainees: A Function of Gender? DTIC # ADA306073. USARIEM, Natick, MA, 1996.
5. Westphal, K.A., K.E. Friedl, M.A. Sharp, et al. Health Performance and Nutritional Status of U.S. Army Women During Basic Combat Training. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Natick Technical Report 96-2, November 1995.

Table 6-2 displays the risk of injury (cumulative incidence, %) among men and women in Army basic training in 1984.

- Overall risk of injury was almost twice as high among women.
- Risk of stress fractures among women was over 5 times higher.

Table 6-2. Army - Risk of Injury (Cumulative Incidence, %) Among Men and Women in Basic Training,* 1984

Type of Injury	Men (%)	Women (%)	Risk Ratio (Chi sq, women vs. men, p < .05)
All	27.4%	50.5%	1.8
Lower Extremity	20.9%	44.6%	2.1
Stress Fracture	2.4%	12.3%	5.1
Time Lost†	20.2%	30.1%	1.5

n (men) = 124; n (women) = 186.

* 8 weeks, Fort Jackson, SC.

† The percentage of men and women who lost one or more duty days as a result of a profile for an injury.

Source: Jones, B.H., M.W. Bovee, J.M. Harris, and D.N. Cowan. "Intrinsic Risk Factors for Exercise-Related Injuries Among Male and Female Army Trainees." *American Journal of Sports Medicine* 21(5):705-10, 1993.

Rates of Injury vs. Illness.

Table 6-3 displays the rates of injury and illness among a sample of men and women in Army basic training in 1984.

- The rate of injury-related sick call visits among men is similar to the rate of illness-related sick call visits (14 visits per 100 trainees per month versus 18 visits per 100 trainees per month, respectively).
- The rate of injury-related sick call visits among women is almost the same as the rate for illness-related sick call visits (about 25 visits per 100 trainees per month).
- Men have lower rates of both injury and illness sick call visits as compared to women (14 and 18 visits per 100 trainees per month versus 25 and 24 visits per 100 trainees per month, respectively).
- The rate of injury-related limited duty days among men is significantly higher than the rate of illness-related limited duty days (40 days per 100 trainees per month versus 8 days per 100 trainees per month, respectively).
- The rate of injury-related limited duty days among women is substantially higher than the rate of illness-related limited duty days (129 days per 100 trainees per month versus 6 days per 100 trainees per month, respectively).
- Men have a lower rate of injury-related limited duty days than women (40 days per 100 trainees per month versus 129 days per 100 trainees per month, respectively).
- Men have a slightly higher rate of illness-related limited duty days than women (8 days per 100 trainees per month versus 6 days per 100 trainees per month, respectively).

Table 6-3. Army - Rates of Injury and Illness Among Men and Women in Basic Training,* 1984

Types	Rate (n/100/mo)		Risk Ratio†
	Injury	Illness	
One or more sick call visits - Men	14	18	0.8
One or more sick call visits - Women	25	24	1.0
Days of limited duty - Men	40	8	5.0
Days of limited duty - Women	129	6	22.0

n (men) = 124; n (women) = 186.

* 8 weeks, Fort Jackson, SC.

† Risk ratio = injury rate/illness rate.

Source: Jones, B.H., R. Manikowski, J.R. Harris, et al. Incidence of and Risk Factors for Injury and Illness Among Male and Female Army Basic Trainees. U.S. Army Research Institute of Environmental Medicine Technical Report No. T19/88, 1988.

Distribution of Injury Types.

Table 6-4 displays the frequency and distribution of injury types for all sick call visits among men and women in Army basic training in 1984. The top three injuries for men were:

- Musculoskeletal pain—32.7%.
- Low back pain—16.4%.
- Tendinitis—14.5%.

The top three injuries for women were:

- Musculoskeletal pain—37.5%.
- Stress fracture—19.7%.
- Muscle strain—16.3%.

Table 6-4. Army - Frequency and Distribution (%) of Injuries by Type for All Sick Call Visits Among Men and Women in Basic Training,* 1984

Types of Injury	Men		Women	
	n	%	n	%
Musculoskeletal Pain	18	32.7%	55	37.5%
Low Back Pain	9	16.4%	3	2.0%
Tendinitis	8	14.5%	10	6.8%
Sprain	6	10.9%	11	7.5%
Stress Fracture	4	7.3%	29	19.7%
Muscle Strain	3	5.5%	24	16.3%
Overuse Knee Pain	1	1.8%	5	3.4%
Blisters	1	1.8%	6	4.1%
Other	5	9.1%	4	2.7%
TOTAL	55	100.0%	147	100.0%
Injury sick call visits per 100 trainees per week	5.5	—	9.9	—

n (men) = 124; n (women) = 186.

* 8 weeks, Fort Jackson, SC.

Source: Jones, B.H., R. Manikowski, J.H. Harris, et al. Incidence of and Risk Factors for Injury and Illness Among Male and Female Army Basic Trainees. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Technical Report T19-88, June 1988.

Table 6-5 displays the frequency and distribution of lower extremity musculoskeletal injuries among a sample of 303 Army personnel in infantry initial entry training in 1987. The top three specific injuries were:

- Strains—15.1%.
- Ankle sprain—11.0%.
- Overuse knee injury—10.5%.

Table 6-5. Army - Frequency and Distribution (%) of Lower Extremity Musculoskeletal Injuries Among Personnel in Infantry Training,* 1987

Types of Injury	Frequency	% of Total
Pain Not Otherwise Specified	72	41.9%
Strains	26	15.1%
Ankle Sprain	19	11.0%
Overuse Knee Injury	18	10.5%
Stress Fractures	9	5.2%
Fasciitis	7	4.1%
Stress Reactions of Bone	6	3.5%
Other Sprain	3	1.7%
Achilles Tendinitis	3	1.7%
Bursitis	2	1.2%
Fracture	2	1.2%
Unknown or Not Otherwise Specified	5	2.9%
TOTAL	172	100%

n (population/sample size) = 303.

* 12 weeks, Fort Benning, GA.

Source: Cowan, D., B. Jones, J.P. Tomlinson, et al. The Epidemiology of Physical Training Injuries in U.S. Army Infantry Trainees: Methodology, Population, and Risk Factors. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Technical Report T4-89, November 1988.

Risk Factors for Physical Training Injuries.

- **Personal Characteristics and Fitness (Intrinsic) Factors.** Intrinsic and extrinsic risk factors have been examined by U.S. Army researchers over the past decade. Potential intrinsic risk factors include low level of fitness (weaker, slower run time), body fat (high percentage), anatomy (flat feet, bow legs), gender (women), age (older), and prior injury (severe injuries). The following conclusions were reached in studies of trainees:
 - Anecdotal reports, however, have suggested that the shortest women, and possibly men, are at greater risk of injuries during basic training. These reports also seem to indicate that both the leanest and most overweight trainees in basic training may be at a greater risk of injury.
 - Between 1984 and 1988, run times became slower and the number of sit-ups completed on the initial Army Physical Fitness Training (APFT) declined for both men and women.
 - Of all the fitness measures in the APFT, run time is most consistently associated with injury incidence.
- **External (Extrinsic) Factors.** Potential extrinsic risk factors include training parameters (amount, intensity, etc.), equipment (shoes, boots, etc.), and environmental factors (terrain, weather, etc.).
 - A study of men in infantry training showed that a high mileage unit, running 130 miles in 12 weeks, sustained a higher injury incidence and slower final run time as compared to a unit that ran 56 miles in 12 weeks (Jones et al., 1994).

- **Behavioral Health Risks.** Recent studies have examined the association of behavioral health risk factors (i.e., alcohol consumption and smoking habits) prior to entry into the Army and risks of injury during basic training.
 - Male and female trainees who smoked prior to basic training had a higher incidence of injury compared to nonsmokers (Westphal et al., 1995; Jones et al., 1993).
 - Female trainees who drank four to five drinks per week prior to basic training had a 20% greater risk of injury compared to nondrinkers (Westphal et al., 1995).

Table 6-6 displays the personal characteristics and fitness factors among men and women upon entry to Army basic training in 1984 and 1988.

Table 6-6. Army - Personal Characteristics and Fitness Factors Among Men and Women Upon Entry to Basic Training,* 1984 and 1988

Variables	Men (mean)		Women (mean)	
	1984 (n=124)	1988 (n=1,053)	1984 (n=186)	1988 (n=896)
Age (yrs)	20.2	20.1	21.2	20.2
Height (cm)	175.2	175.2	163.3	162.0
Weight (kg)	73.6	75.7	58.7	58.3
BMI (wt/ht ²)	24.3	24.6	22.4	22.2
Body Fat (%)	16.9	16.1	25.2	26.8
1-Mile Run (min)	7.2	7.6	9.7	10.3
2-Mile Run (min)	—	16.4	—	20.3
Sit-ups (#)	54.5	44.3	39.7	33.9
Push-ups (#)	31.0	30.5	12.4	10.3

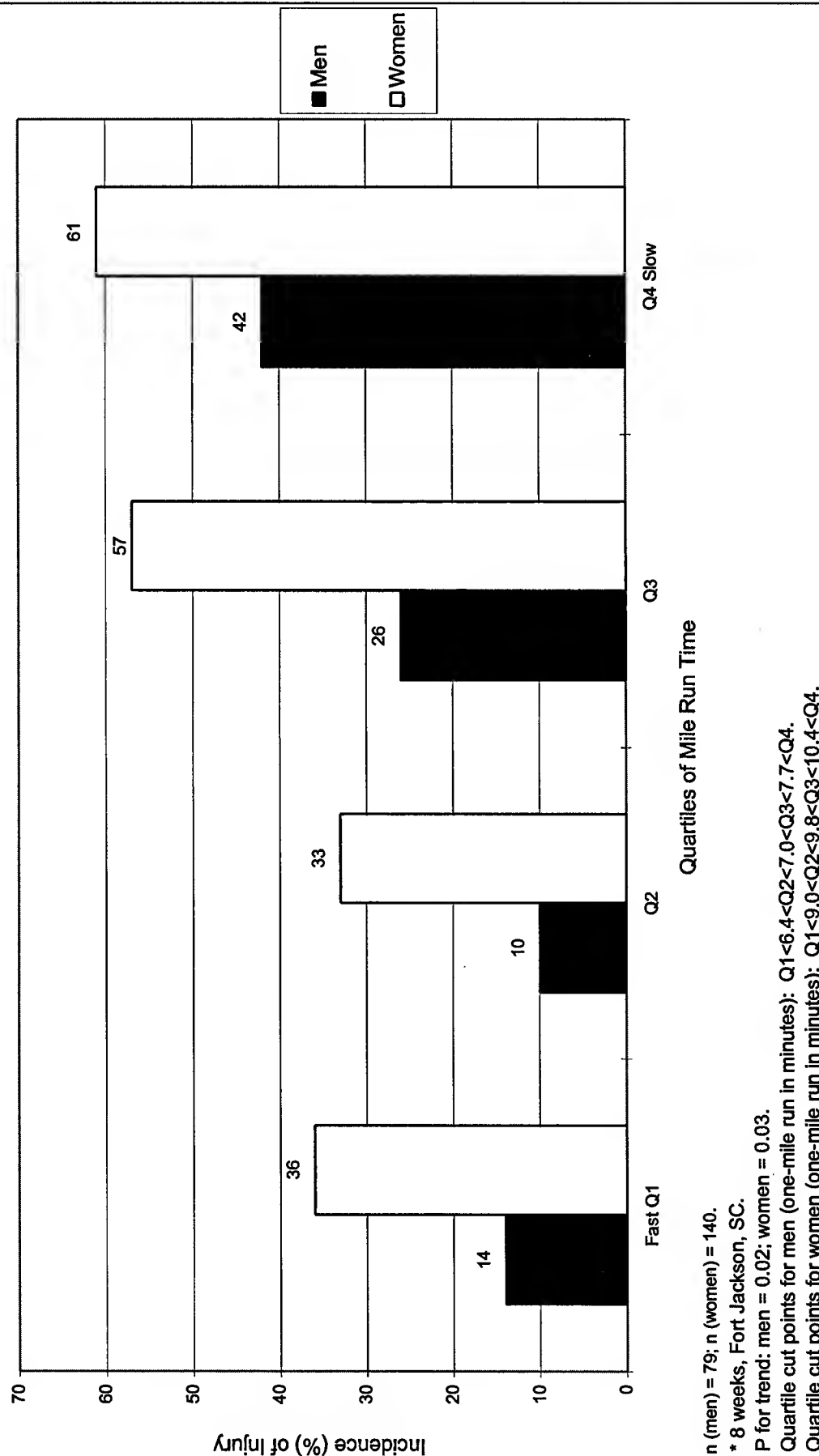
* 8 weeks, Fort Jackson, SC.

Source: Jones, B.H., M.W. Bovee, and J.J. Knapik. "Associations Among Body Composition, Physical Fitness, and Injury in Men and Women Army Trainees." In *Body Composition and Physical Performance*, National Academy Press, Washington, DC, 1992, pp. 141-173.

Figure 6-1 illustrates the run time, a measure of aerobic fitness, and incidence of injury among men and women in Army basic training in 1984.

- Male and female trainees with slow mile run times on the diagnostic APFT showed a higher risk of injury during basic training compared to faster runners.
- The slowest male trainees had 3 times greater risk of injury as compared to the fastest male trainees.
- The slowest female trainees had 1.7 times greater risk of injury as compared to the fastest female trainees.
- For both men and women, the data shows a trend of increasing risk with successively slower run times.

Army - Run Time and Incidence (%) of Injury Among Men and Women in Basic Training,* 1984



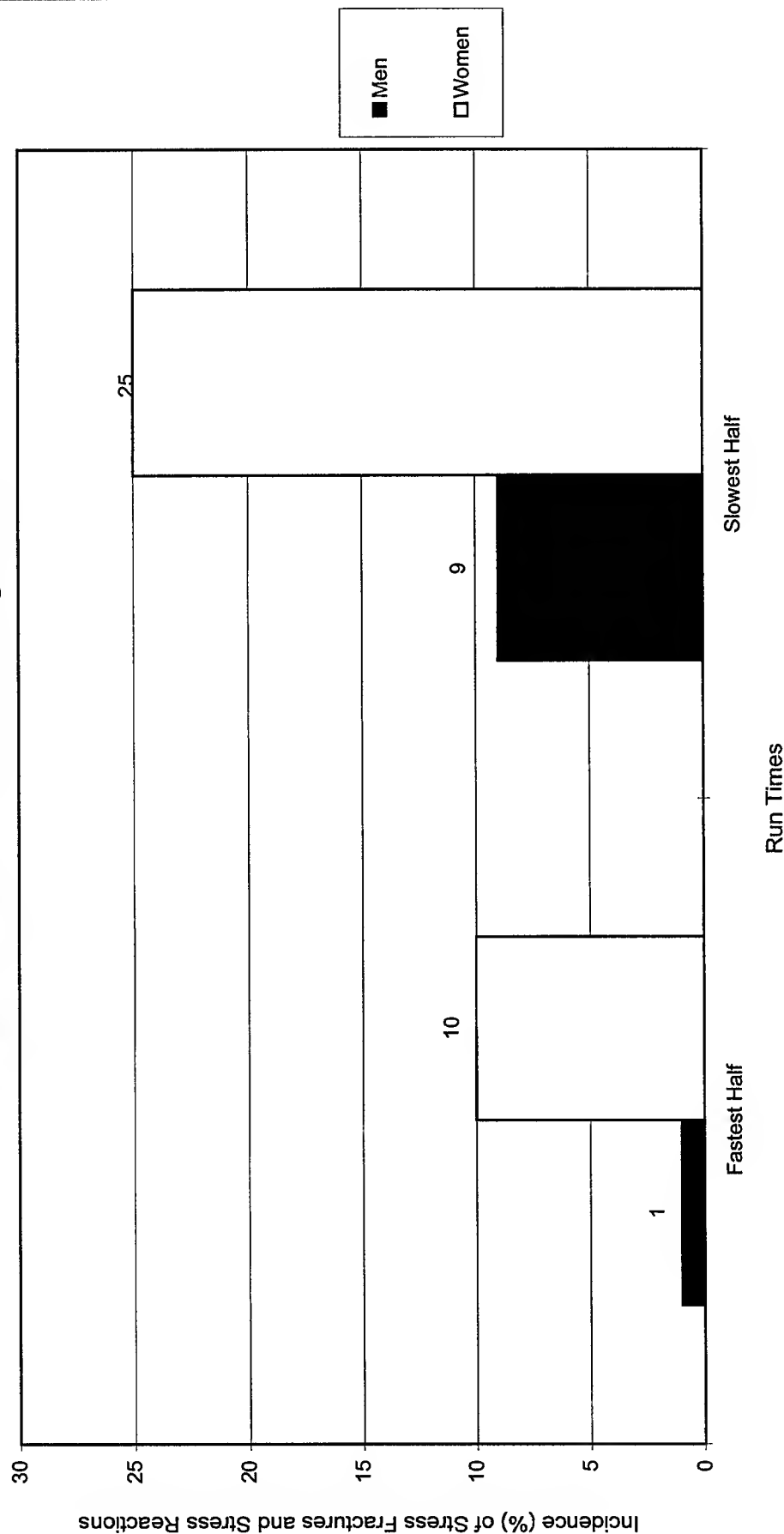
Source: Jones, B.H., M.W. Bovee, and J.J. Knapik. "Associations Among Body Composition, Physical Fitness, and Injury in Men and Women Army Trainees." In *Body Composition and Physical Performance*, National Academy Press, Washington, DC, 1992, pp. 141-173.

Figure 6-1

Figure 6-2 illustrates the run time and incidence of stress fractures and stress reactions among men and women in Army basic training in 1995.

- Stress fractures and stress reactions are common overuse injuries that often result in significant time lost from training.
- The trends are the same as seen with injuries overall; among both men and women, the slower trainees had a higher stress fracture incidence as compared to the faster trainees.
- Women were at a three times greater risk than men of sustaining a stress fracture or stress reaction.

Army - Run Time* and Incidence (%) of Stress Fractures and Stress Reactions Among Men and Women in Basic Training,† 1995



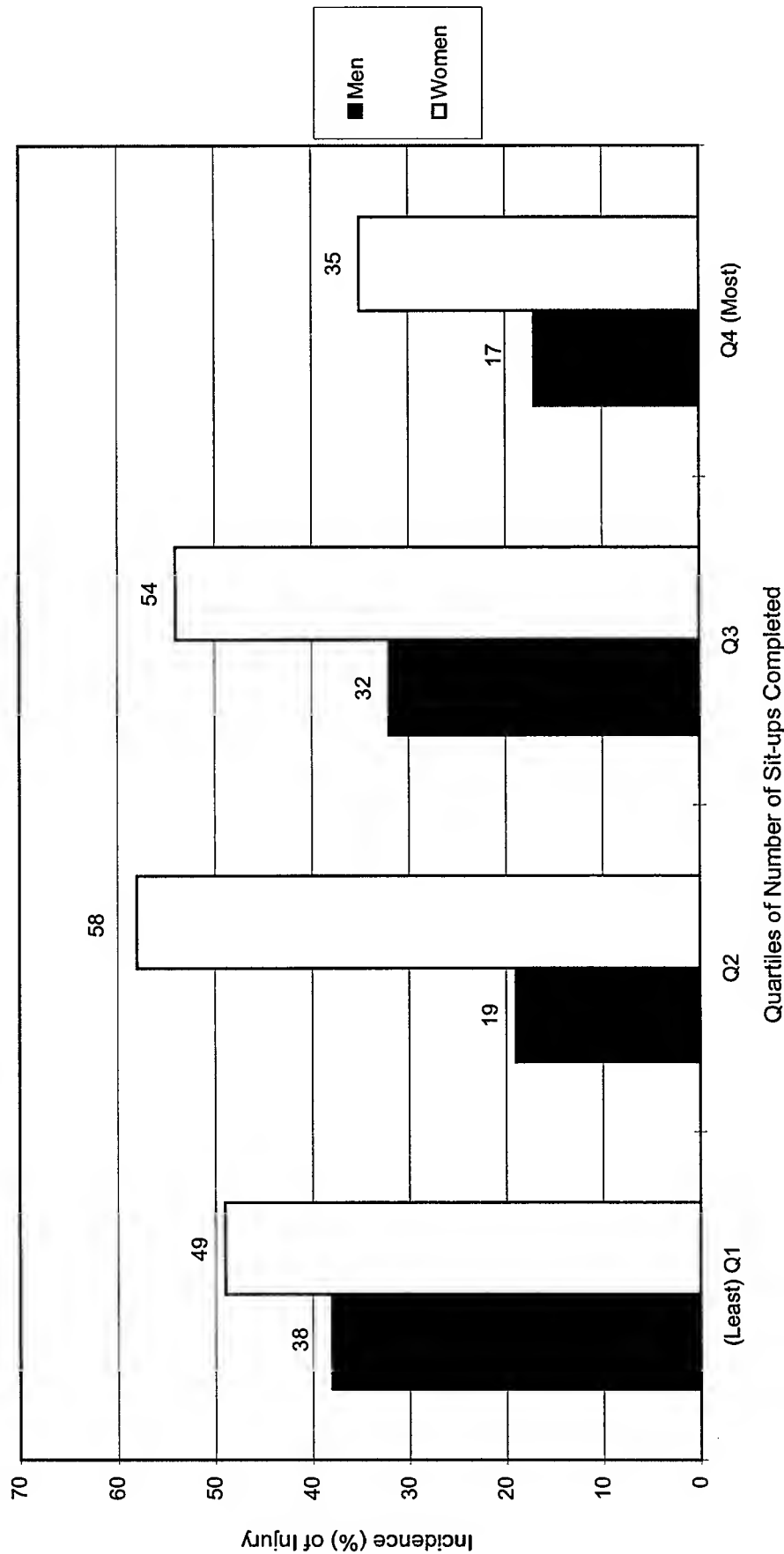
n (men) = 155; n (women) = 95.
 * 2-mile run time on diagnostic Army physical fitness test;
 median for men = 17.7 minutes, women = 22.5 minutes.
 † Two companies in their seventh week of 8 weeks of training, Fort Leonard Wood, MO.

Source: Canham, M.L., M.A. McFerrer, and B.H. Jones. "The Association of Injury with Physical Fitness Among Men and Women in Gender-Integrated Basic Training Units." *USACHPPM Medical Surveillance Monthly Report* 2(2):8-10, 12, April 1996.

Figure 6-3 illustrates the association of sit-ups, a measure of muscle endurance, with incidence of injury among men and women in Army basic training in 1984.

- For both men and women, injury incidence was lower among those who completed the most sit-ups (quartile 4) on the diagnostic APFT.

Army - Sit-ups and Incidence (%) of Injury* Among Men and Women in Basic Training,† 1984



n (men) = 124; n (women) = 186.

* Injury = 1 or more sick call visits for musculoskeletal complaint during basic training cycle.

† 8 weeks, Fort Jackson, SC, diagnostic Army physical fitness test.

Quartile cut points for men: Q1<47<Q2<52<Q3<64<Q4; quartile cut points for women: Q1<30<Q2<39<Q3<46<Q4.

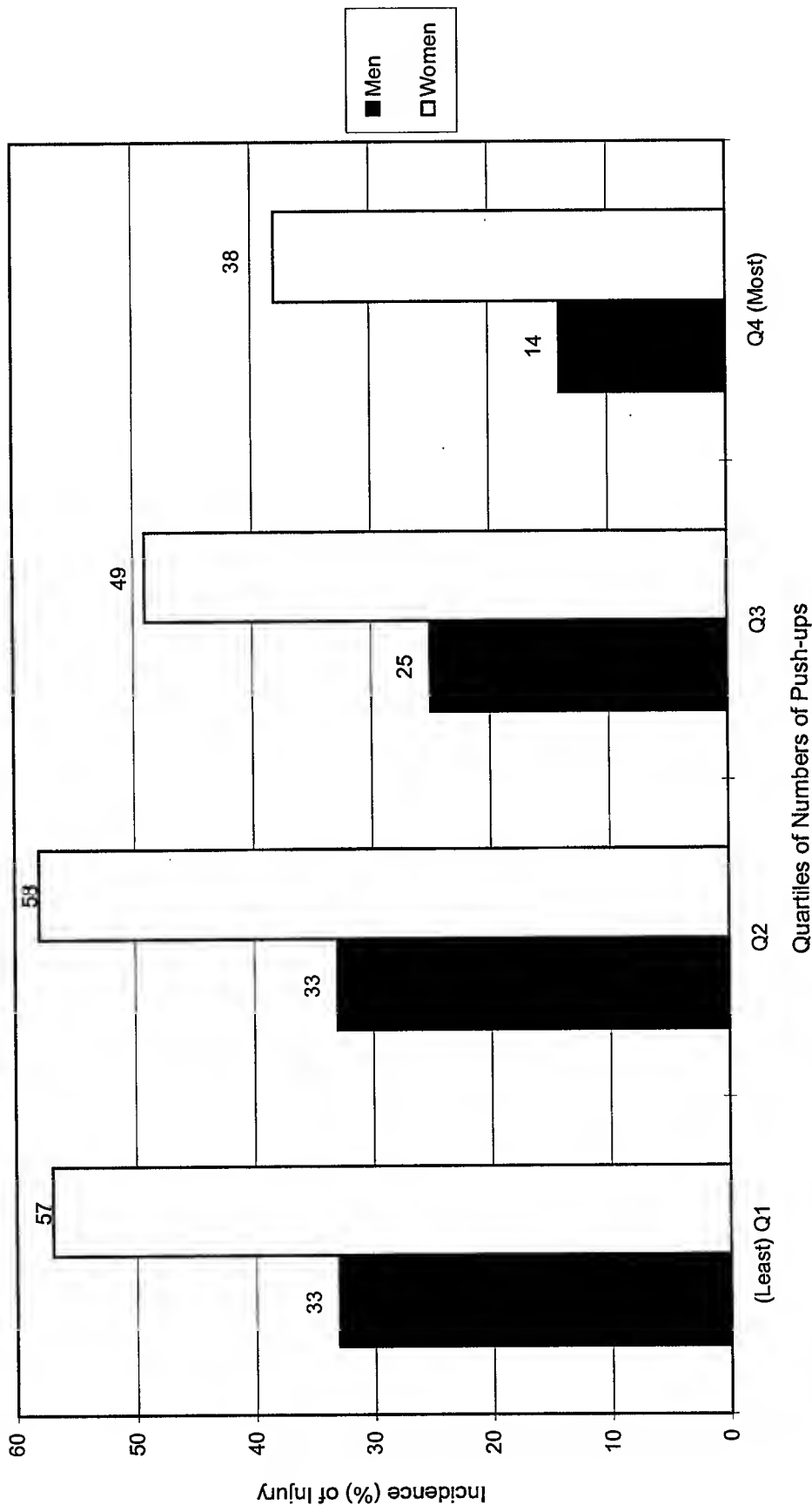
Source: Jones, B.H., R. Manikowski, J.H. Harris, et al. Incidence of and Risk Factors for Injury and Illness Among Male and Female Army Basic Trainees. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Technical Report T19-88, June 1988.

Figure 6-3

Figure 6-4 illustrates push-ups, a measure of muscle endurance, and incidence of injury among men and women in Army basic training in 1984.

- Male and female trainees who performed higher numbers of push-ups (as measured by quartiles of push-ups) had a lower incidence of training-related injuries.

Army - Push-ups and Incidence (%) of Injury Among Men and Women in Basic Training,* 1984



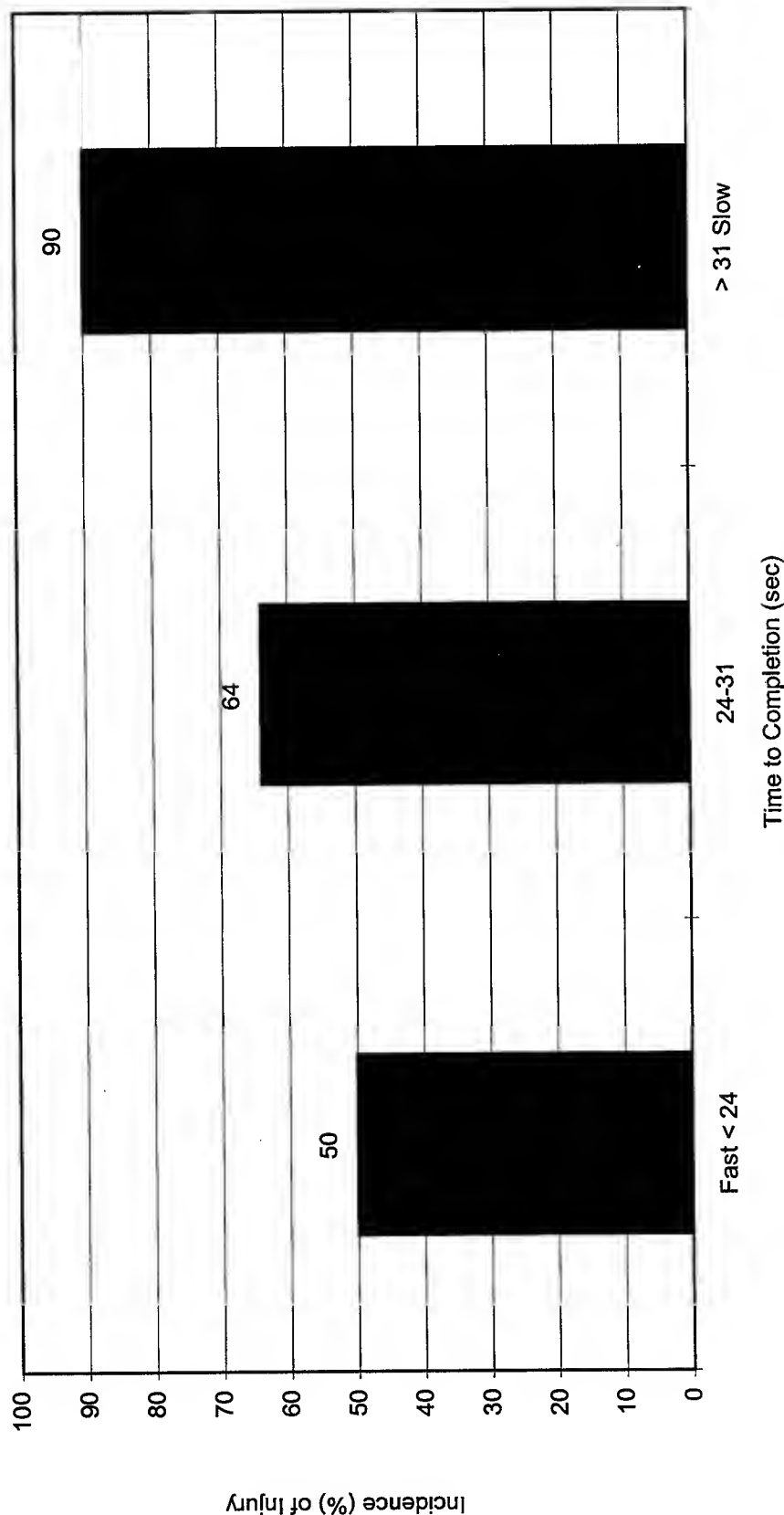
n (men) = 124. MH Chi trend = 2.6; p-value = 0.10. Average push-ups = 31 (+/- 9).
n (women) = 186. MH Chi trend = 3.0; p-value = 0.08. Average push-ups = 12 (+/- 10).
* 8 weeks, Fort Jackson, SC.
Quartile cut points for men: Q1<27<Q2<31<Q3<36<Q4; quartile cut points for women: Q1<.5<Q2<11<Q3<17<Q4.

Source: Jones, B.H. Jones, B.H., R. Manikowski, J.H. Harris, et al. Incidence of and Risk Factors for Injury and Illness Among Male and Female Army Basic Trainees. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Technical Report T19-88, June 1988.

Figure 6-4

Figure 6-5 illustrates performance on a load carriage task, a measure of muscle strength and muscle endurance, and incidence of injury among women in Army basic training in 1993. There is a highly significant trend of increasing injury among female trainees with slower load carriage task performance (e.g., lifting an 18.2 kg box and carrying it around a 91.4-meter course for time).

Army - Load Carriage Task and Incidence (%) of Injury Among Women in Basic Training,* 1993



n = 156 (fast = 28; slow = 29).

* 8 weeks, Fort Jackson, SC.

Load carriage task = lift and carry 18.2 kg over distance of 91.4 m.

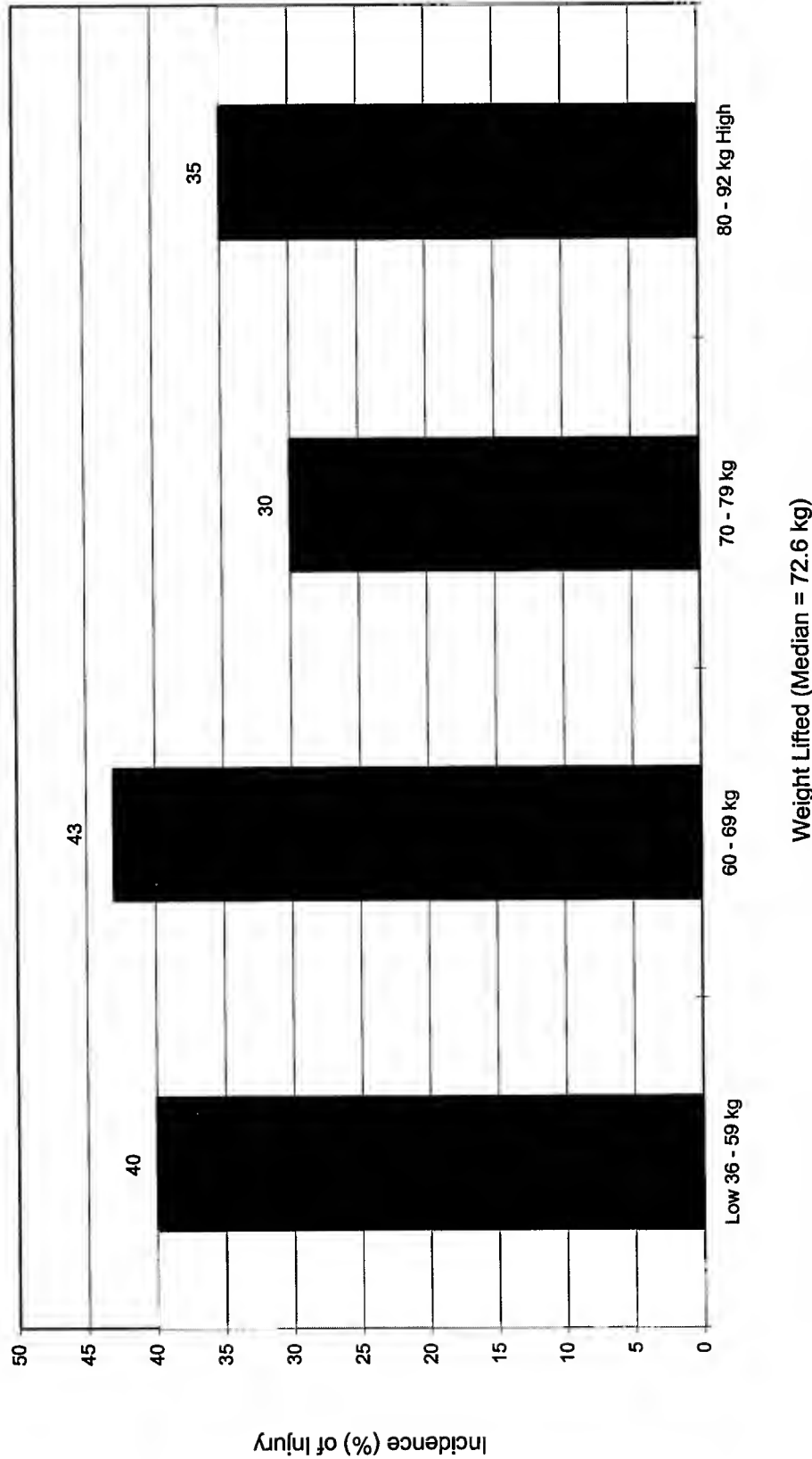
MH Chi trend = 9.99; p-value = 0.001.

Source: Jones, B.H. 1997. "Physical Fitness and Injuries Among Women in the U.S. Army." *Optimizing the Performance of Women in the Armed Forces of NATO*, Technical Proceedings. AC/243 (Panel 8) PP/13.

Figure 6-5

Figure 6-6 illustrates performance on the dynamic lift test, a measure of muscle strength, and incidence of injury among men in Army infantry initial training in 1987. Male trainees who could lift more weight on a dynamic lift test (e.g., lifting a rack of weights on a machine from floor to chest height) had a slightly reduced risk of injury during the 12 weeks of infantry basic training. Although this association was not significant, risks appeared to lower for those with greater muscle strength.

Army - Dynamic Lift Test and Incidence (%) of Injury Among Men in Infantry Initial Entry Training,* 1987



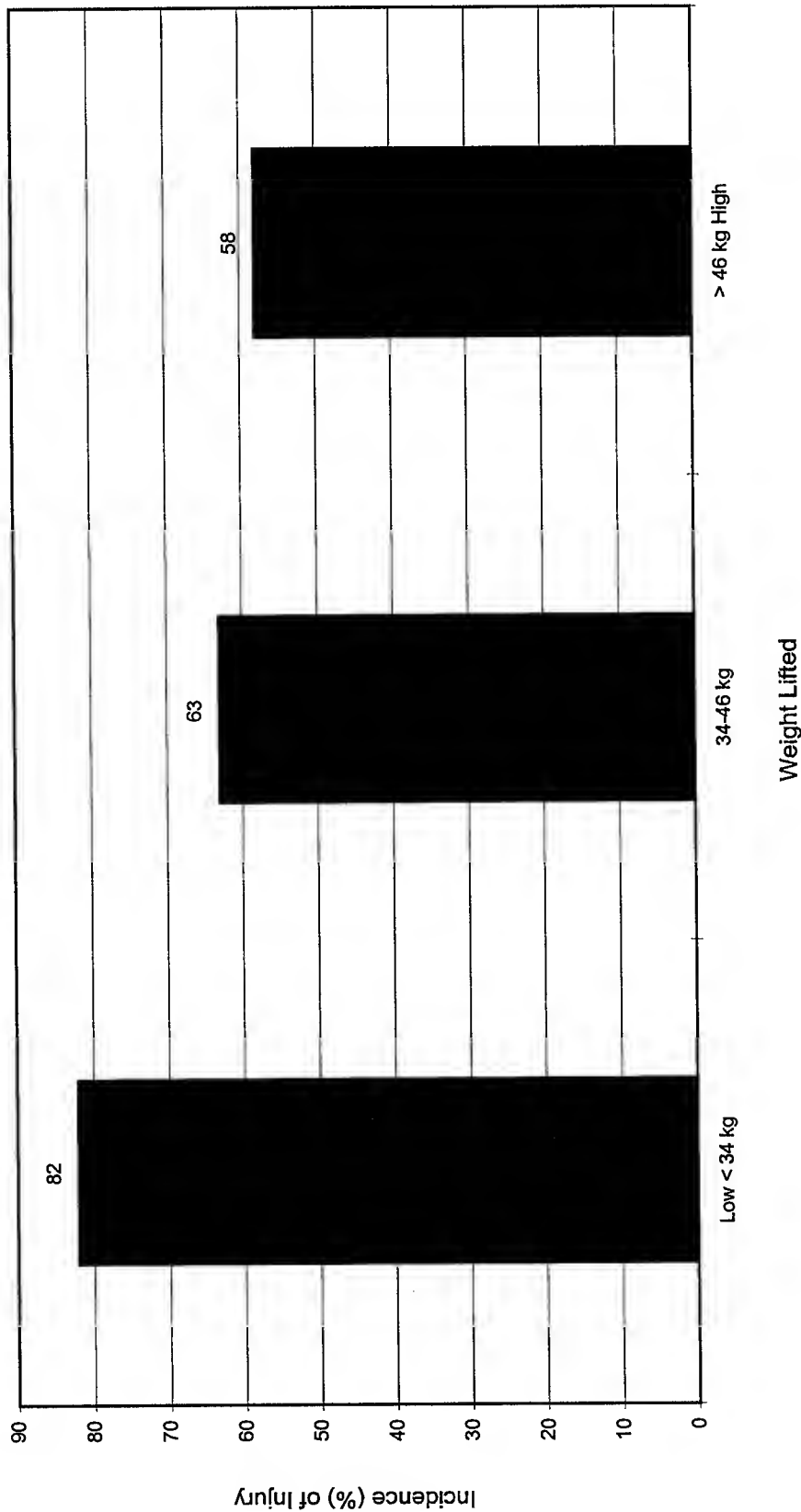
n = 303.
 * 12 weeks, Fort Benning, GA.
 Dynamic lift test = maximum amount (kg) lifted overhead.
 Relative risks (low vs. high) = 1.1.

Source: Cowan D., B. Jones, J.P. Tomlinson, et al. The Epidemiology of Physical Training Injuries in U.S. Army Infantry Trainees: Methodology, Population, and Risk Factors. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Technical Report: T4-89, November 1988.

Figure 6-6

Figure 6-7 illustrates performance on the dynamic lift test, a measure of muscle strength, and incidence of injury among women in Army basic training in 1993. Female trainees showed a similar, though much more significant, trend between lifting more weight and fewer injuries in basic training as compared to men in infantry basic training. A less significant correlation with injury incidence was found when muscle strength was measured using a bench press.

Army - Dynamic Lift Test and Incidence (%) of Injury Among Women in Basic Training,* 1993



n = 158 (n (low) = 34; n (high) = 31).

* 8 weeks, Fort Jackson, SC.

Relative risks (low vs. high) = 1.4; p-value < 0.05.

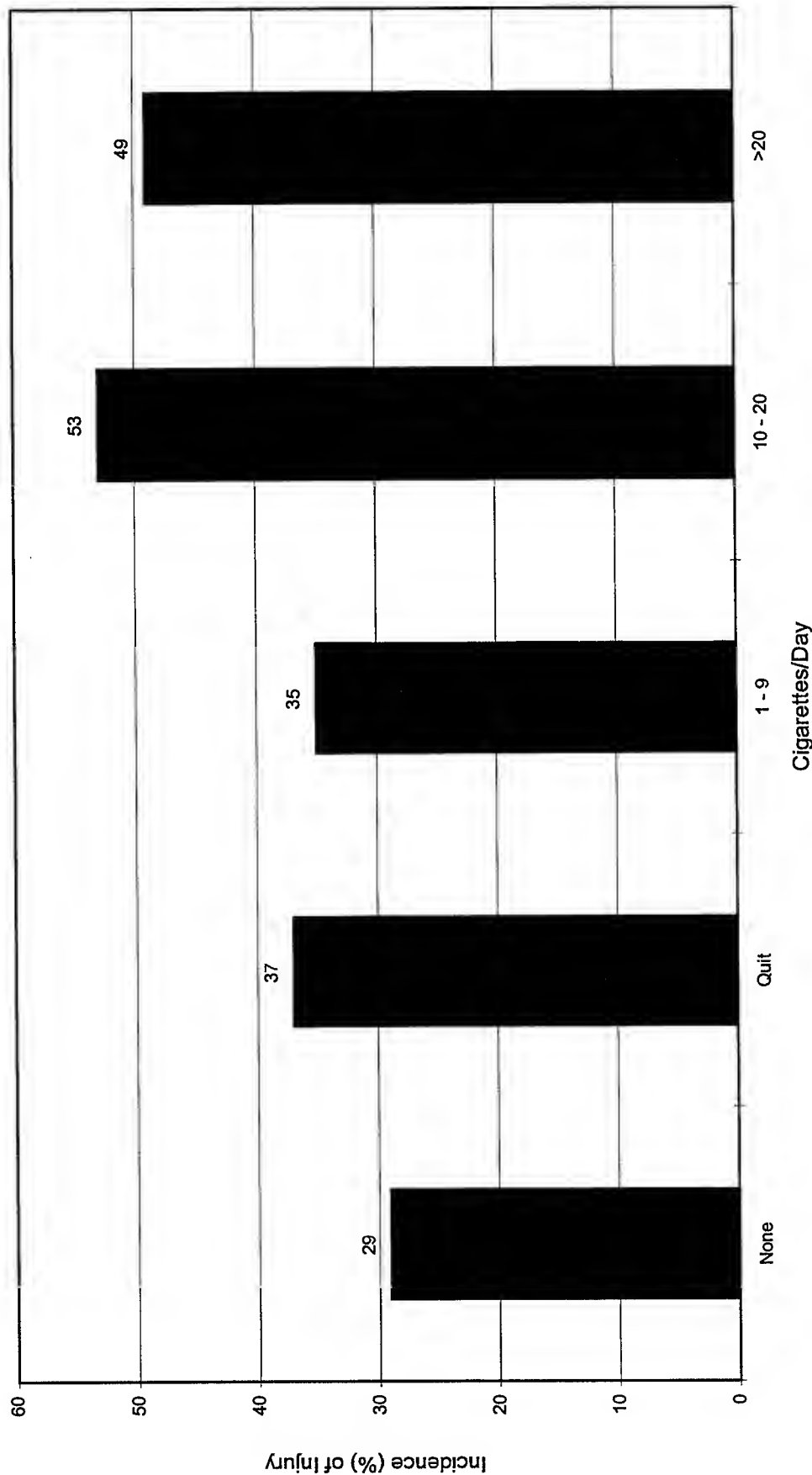
Source: Jones, B.H. 1997. "Physical Fitness and Injuries Among Women in the U.S. Army." *Optimizing the Performance of Women in the Armed Forces of NATO*, Technical Proceedings. AC/243 (Panel 8) PP/13.

Figure 6-7

Figure 6-8 illustrates the relationship of cigarette smoking with the incidence of lower extremity injuries among men in Army infantry initial entry training in 1987.

- The largest incidence of injury occurred among men who smoked between 10 to 20 cigarettes a day prior to basic training (53% vs. 29% for nonsmokers).
- Men who smoked more than 10 cigarettes per day were at significantly greater risk of injury as compared to nonsmokers, those who quit, and those who smoked 1 to 9 cigarettes per day, even when differences in physical fitness were taken into consideration.

Army - Cigarette Smoking and Incidence (%) of Lower Extremity Injuries Among Men in Infantry Training,* 1987



n = 299.
 * 12 weeks follow-up, Fort Benning, GA.
 Chi sq p < 0.05; odds ratio = 1.9; 95% confidence interval = 1.1, 3.3 (smokers > 10 cigarettes/day or nonsmokers).

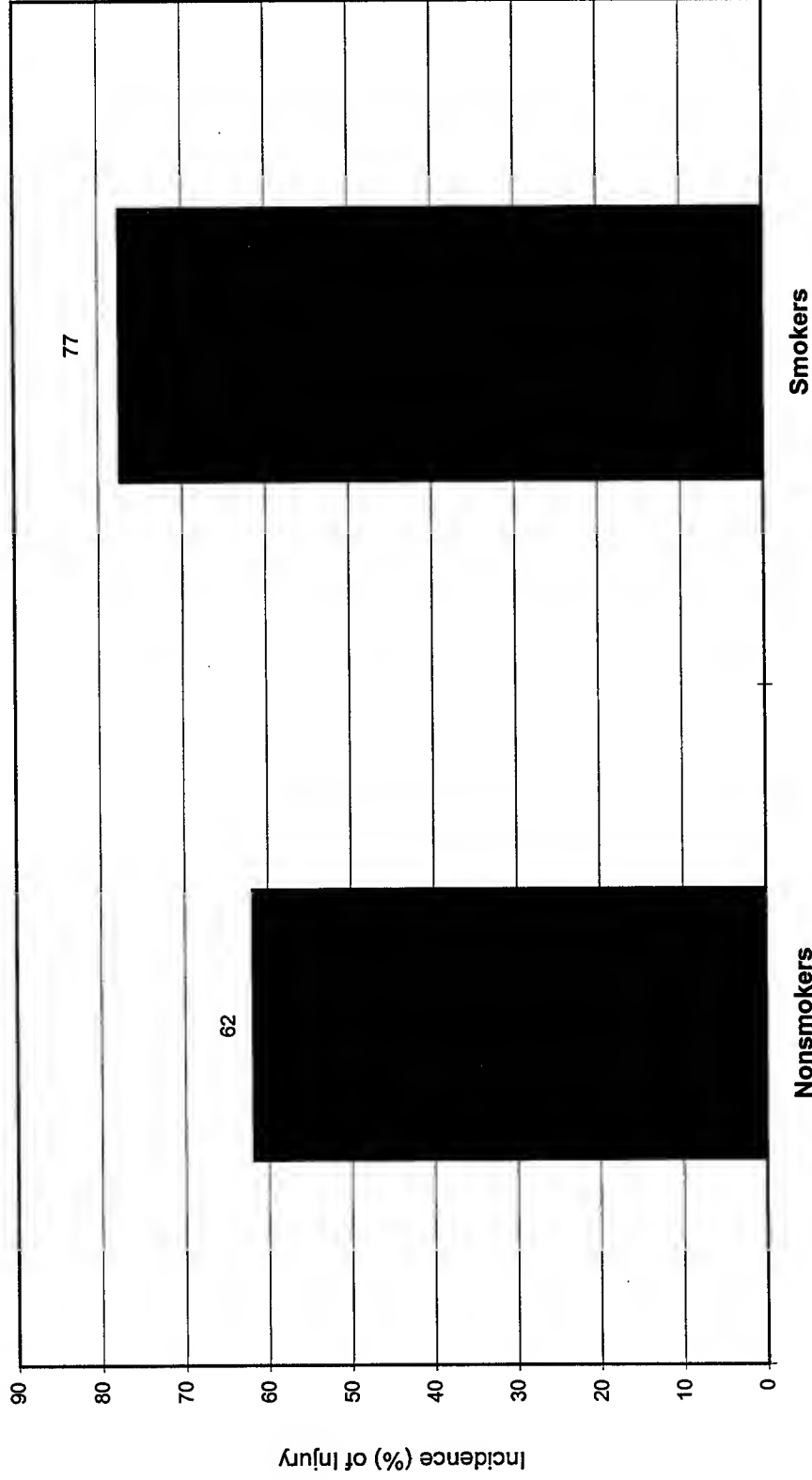
Source: Jones, B.H., D.N. Cowan, J.P. Tomlinson, et al. "Epidemiology of Injuries Associated with Physical Training Among Young Men in the Army." *Med. Sci. Sports Ex.* 25(2):197-203, 1993.

Figure 6-8

Figure 6-9 illustrates the relationship of cigarette smoking with the incidence of injury among women during Army basic training in 1993.

- Injury risk for women who were smokers prior to basic training was 1.2 times higher than the injury risk for nonsmokers.

Army - Cigarette Smoking and Incidence (%) of Injury Among Women in Basic Training,* 1993



n (nonsmokers) = 110; n (smokers) = 53).

* 8 weeks, Fort Jackson, SC.

Relative risk of smokers vs. nonsmokers = 1.25; p-value < 0.05.

Source: Westphal, K.A., K.E. Friedl, M.A. Sharp, et al. Health Performance and Nutritional Status of U.S. Army Women During Basic Combat Training. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Natick Technical Report T96-2, November 1996.

Figure 6-9

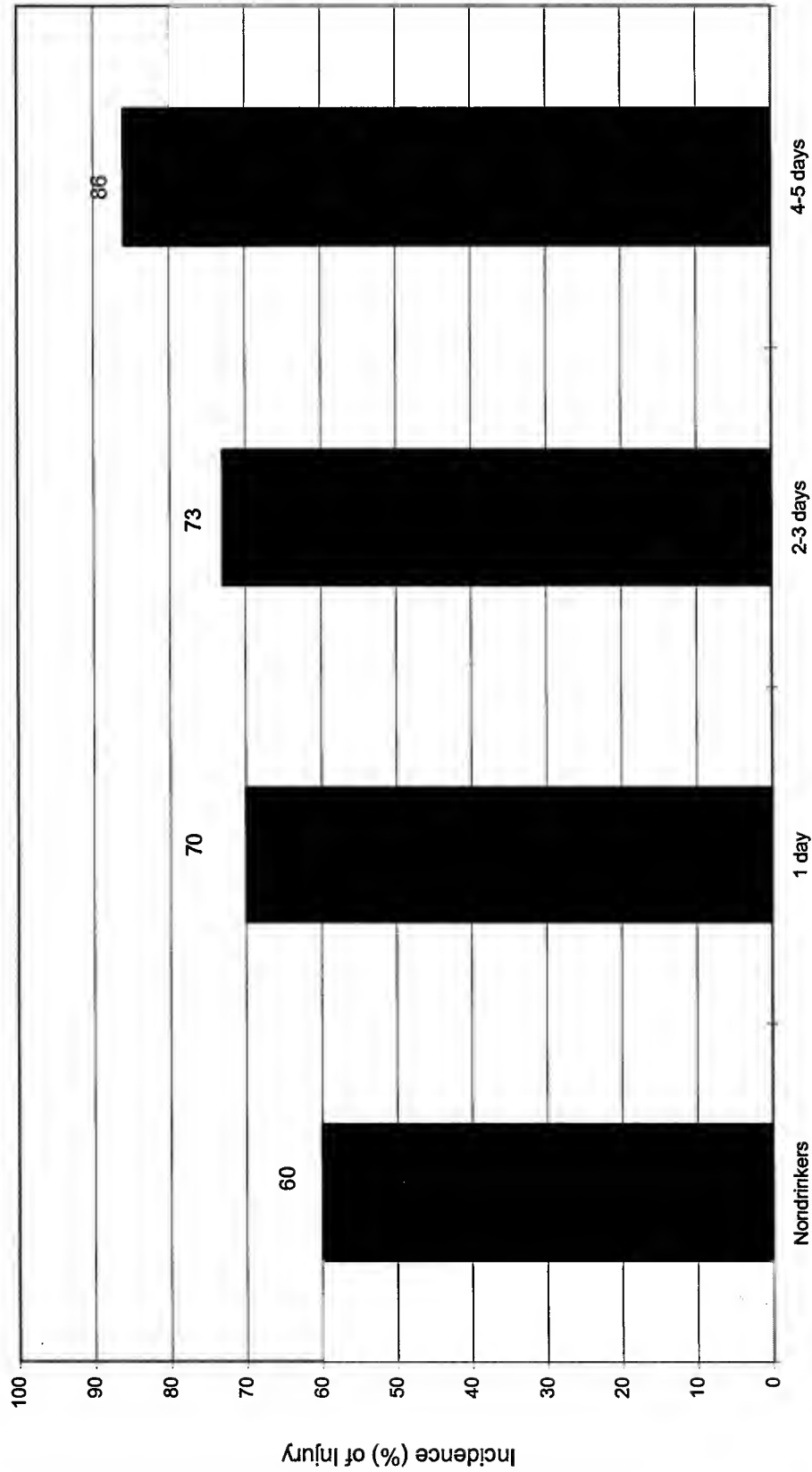
Figure 6-10 illustrates the association of alcohol consumption with incidence of injury among women during Army basic training in 1993.

- Injury risk was higher for those who consumed greater amounts of alcohol.

Another study of 15,295 infantry soldiers showed similar results. Those soldiers who reported alcohol use had a 1.25 greater risk of injury as compared to those who reported no alcohol use.*

* Tomlinson, J.P., W.M. Lednar, and J.D. Jackson. "Risk of Injury in Soldiers." *Military Medicine* 152(2):60-64, 1987.

Army - Alcohol Consumption and Incidence (%) of Injury Among Women in Basic Training,* 1993



n = 162.
 * 8 weeks, Fort Jackson, SC.
 Relative risk = low vs. high = 1.43; 95% confidence interval = 0.99-2.06.
 Chi sq for trend = 5.3; p-value = 0.02.

Source: Westphal, K.A., K.E. Friedl, M.A. Sharp, et al. Health Performance and Nutritional Status of U.S. Army Women During Basic Combat Training. U.S. Army Research Institute of Environmental Medicine, Natick, MA. Natick Technical Report T96-2, November 1996.

Figure 6-10

Table 6-7 displays the effects of high and low running mileage on injury rates and run times among male personnel in infantry initial entry training in 1987.

- The high-running mileage unit had a 27% higher risk of lower extremity injury than the lower-running mileage unit.
- The high-running mileage unit had a slower average 2-mile run time on the final physical fitness test.
- The higher running mileage increased injury risk and did not impart any additional aerobic endurance benefits.
- This data suggest that there are thresholds of training (running mileages) above which injury rates increase and physical fitness fails to improve.

Table 6-7. Army - Effects of High and Low Running Mileage on Injury Rates and Run Times Among Male Personnel in Infantry Training,* 1987

Mileage	Lower Extremity Injury Incidence (%)	2-Mile Run Time† (minutes:seconds)
Low - 56 miles/12 weeks	33%	13:29
High - 130 miles/12 weeks	42%	13:45
Ratio - high mileage vs. low mileage	1.27	1.02

n (low mileage subjects) = 157; n (high mileage subjects) = 146.

* 12 weeks, Fort Benning, GA.

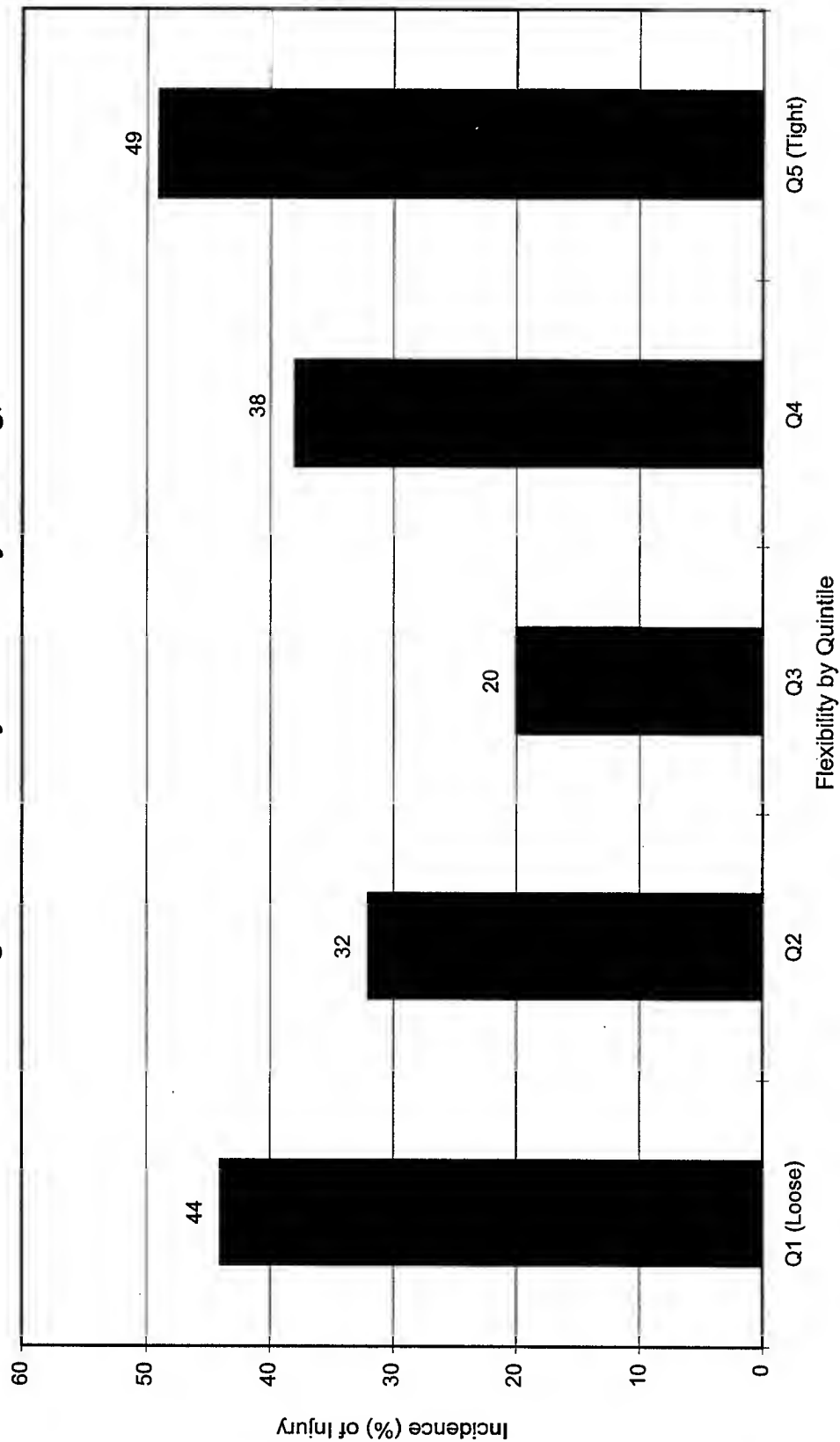
† Final Army physical fitness training average times.

Source: Jones, B.H., and J.J. Knapik. "Exercise, Training, and Injuries." *Sports Med* 18(3):202-213, 1994.

Figure 6-11 illustrates flexibility and incidence of injury among men in Army infantry initial entry training in 1987. Back and hamstring flexibility were measured with a sit-and-reach test. Degree of flexibility was recorded in number of centimeters reached toward toes (negative numbers before the toes, positive numbers beyond the toes).

- Both the most flexible and the least flexible trainees showed higher incidences of injury than those of "average" flexibility.

Army - Flexibility (Sit and Reach) and Incidence (%) of Injury Among Men in Infantry Initial Entry Training,* 1987



n = 303, median = 4.3 cm (RNG = -23 to 24).

* 12 weeks, Fort Benning, GA.

RR Q1 vs Q3 = 2.2, p-value < .05.

RR Q5 vs Q3 = 2.5, p-value < .05.

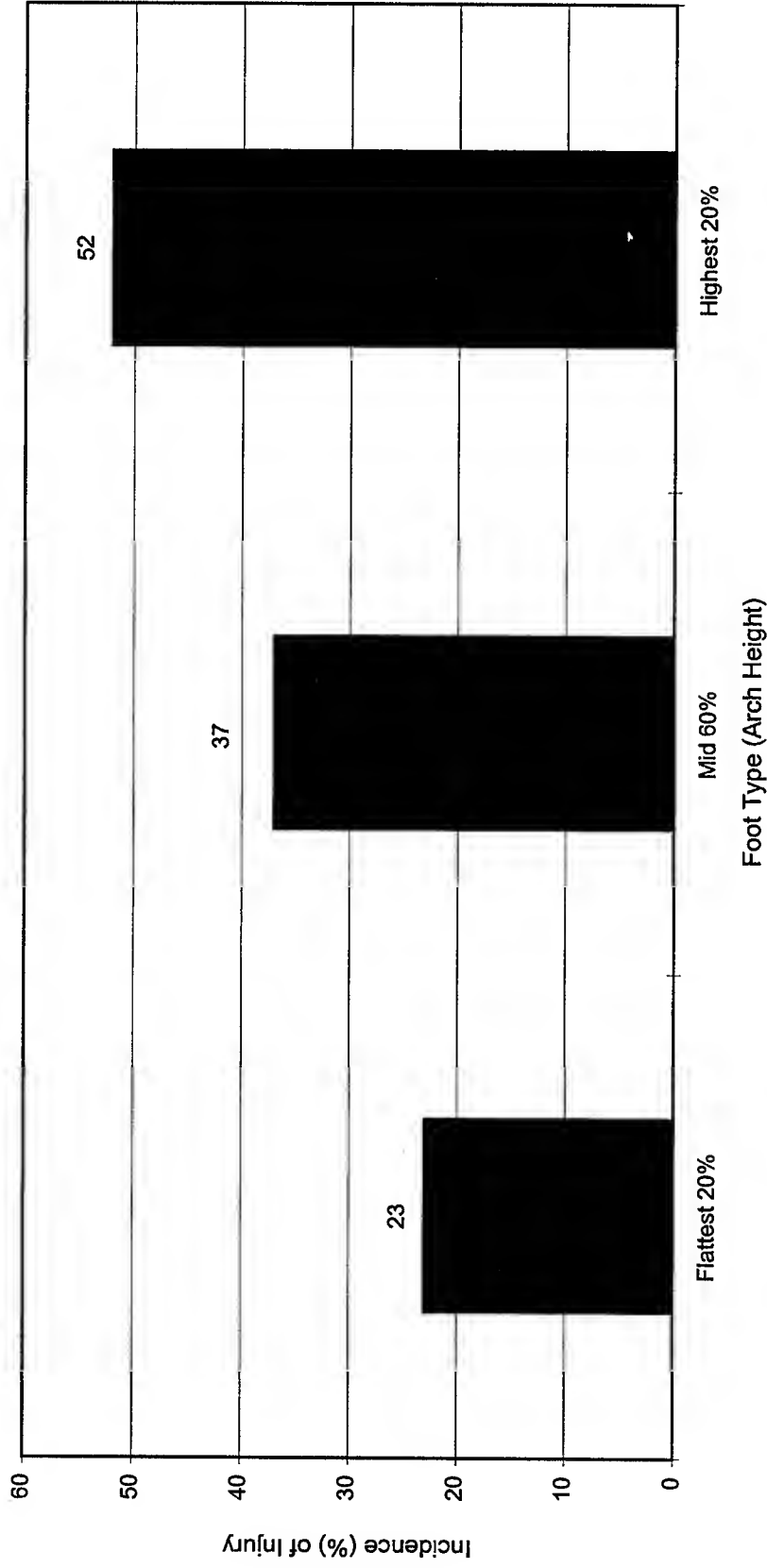
Adapted from Jones, B.H., D.N. Cowan, J.P. Tomlinson, et al. "Epidemiology of Injuries Associated with Physical Training Among Young Men in the Army." *Med. Sci. Sports Ex.* 25(2):197-203, 1993.

Figure 6-11

Figure 6-12 illustrates foot type (arch height) and incidence of lower extremity injuries among personnel in Army infantry initial entry training in 1987.

- Trainees with the highest arches had the highest injury incidence.
- Trainees with the flattest feet had the lowest injury incidence.

Army - Foot Type (Arch Height) and Incidence (%) of Lower Extremity Injuries Among Personnel in Infantry Initial Entry Training,* 1987



n = 246.
* 12 weeks, Fort Benning, GA.
Risk ratio (high vs. flat) = 2.3, p < .05.

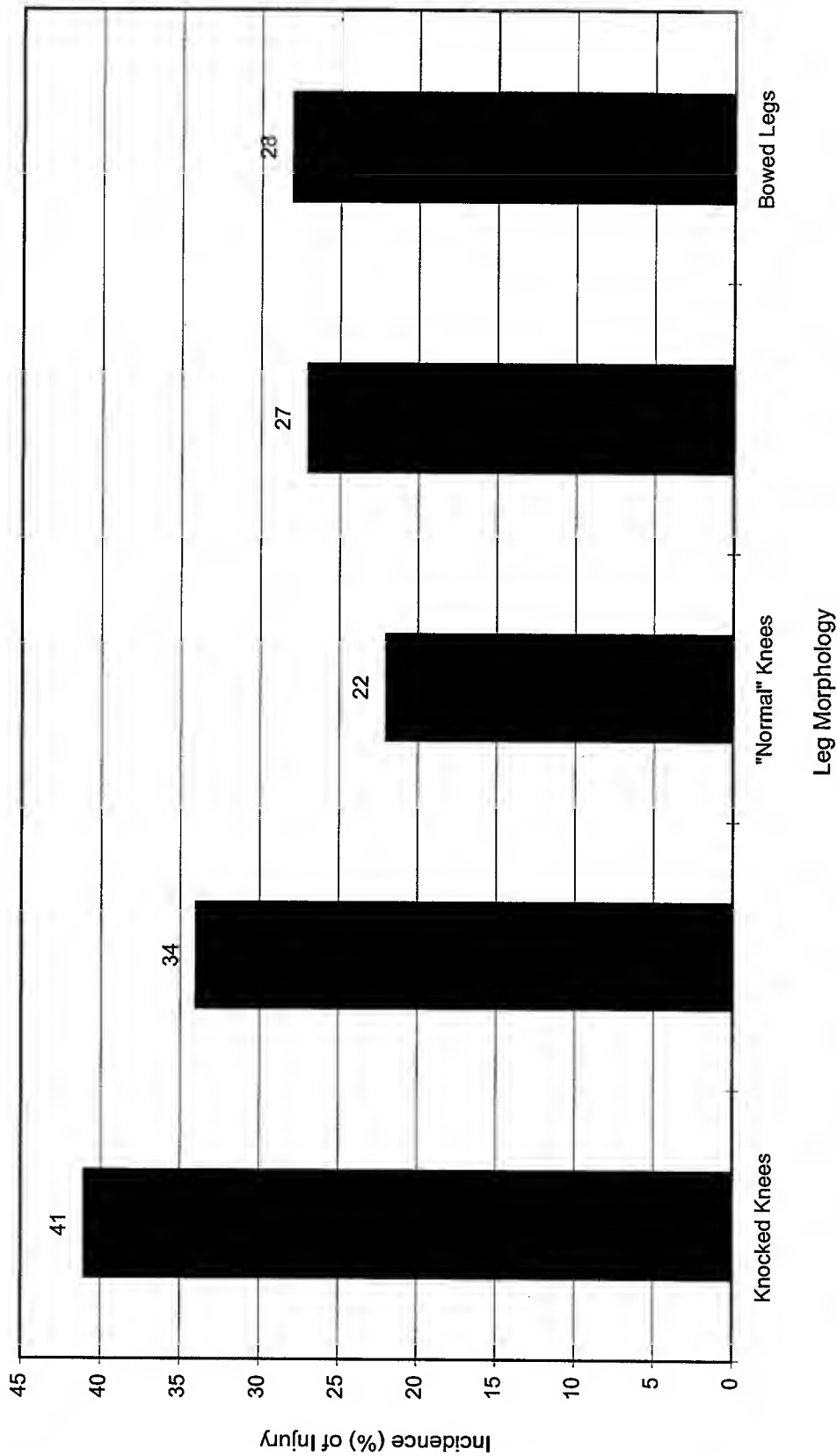
Source: Cowan, D.N., B.H. Jones, and J.R. Robinson. "Foot Morphologic Characteristics and Risk of Exercise-Related Injury." *Arch. Fam. Med.* 2:733-777, 1993.

Figure 6-12

Figure 6-13 illustrates knocked knees, bowed legs, and the incidence of any overuse injury among men in Army infantry initial entry training in 1987.

- Trainees with knocked knees had the highest injury risk (risk ratio = 1.9) compared to trainees with "normal" knees.

Army - Knocked Knees, Bowed Legs, and Incidence (%) of Any Overuse Injury Among Men in Infantry Initial Entry Training,* 1987



n = 294.
* 12 weeks, Fort Benning, GA.

Source: Cowan, D.N. et al. "Lower Limb Morphology and Risk of Overuse Injury Among Male Infantry Trainees." *Medicine and Science in Sports Exercise* 28(8):945-952, 1996.

Figure 6-13

Multiple Risk Factors.

Table 6-8 displays multiple logistic regression analysis for one or more injury visits regressed on demographic and fitness risk factors.

- The strongest predictor of injury is run time on the Army diagnostic physical fitness test.
- When fitness measures are included in the model, gender is not a strong predictor of injury risk.

Table 6-8. Army - Risk Factors for Injury Among Army Basic Trainees

Risk Factors	Odds Ratios*	95% Confidence Intervals
Sex 1 = Men 2 = Women	— 1.14	— 0.48 - 2.72
Race 1 = Black 2 = White 3 = Other	— 1.31 0.84	— 0.89 - 1.94 0.40 - 1.79
Age 1 = <20 2 = 20-24 3 = 25+	— 1.50 1.26	— 1.00 - 2.23 0.69 - 2.31
Run Time† 1 = Fast 2 3 = Average 4 5 = Slow	— 1.47 1.54 2.52 3.23	— 0.68 - 3.18 0.91 - 2.62 1.26 - 5.04 1.59 - 6.58
Sit-ups 1 = High 2 3 = Average 4 5 = Low	— 1.05 0.80 1.15 1.51	— 0.60 - 1.81 0.44 - 1.44 0.63 - 2.09 0.78 - 2.92
Push-ups 1 = High 2 3 = Average 4 5 = Low	— 1.62 1.19 1.34 1.24	— 0.90 - 2.92 0.65 - 2.19 0.66 - 2.71 0.54 - 2.88
Strength 1 = High 2 3 = Average 4 5 = Low	— 1.41 1.61 2.10 2.11	— 0.80 - 2.50 0.90 - 2.88 0.88 - 5.04 0.83 - 5.36

n = 509 men and 352 women in basic combat training, Fort Jackson, SC, 1988.

* An odds ratio is a surrogate for a risk ratio and generally overestimates risk. It is used when a rate cannot be calculated.

† This was the only statistically significant risk factor for injury; (p) < .05.

Source: Bell, N.S., T. W. Mangione, D. Hemenway, P.J. Amoroso, and B. H. Jones. Injury Etiology and Prevention Selected Topics: High Injury Rates Among Female Trainees: A Function of Gender? DTIC # ADA306073. USARIEM, Natick, MA, 1996.

Table 6-9 displays risk factors for lower extremity musculoskeletal injuries among male Army trainees during infantry initial entry training.

- Age, cigarette use, past physical activity, and flexibility were predictors of injury risk, when controlling for the effects of other risk factors in this population of infantry trainees.

Table 6-9. Army - Risk Factors for Lower Extremity Musculoskeletal Injuries Among Male Trainees During Infantry Initial Entry Training

Factor	Lower Extremity Injuries Odds Ratio* (95% Confidence Intervals)
Age (years)	
<24	1.0
≥24	4.3 (2.0, 9.2)†
Cigarettes smoked per day	
<10/day	1.0
≥10 /day	1.9 (1.1, 3.3)†
History of Injury	
No Injury	1.0
Injury (no sprain)	0.6 (0.3, 1.3)
Ankle Sprain	1.7 (0.9, 3.2)
Job Activity	
Heavy - Moderate	1.0
Light - Very Light	1.8 (1.0, 3.2)†
Past Physical Activity	
Above Average	1.0
Average or Less	2.2 (1.3, 3.8)†
Flexibility	
1 = Lowest 20%	3.6 (1.5, 8.6)†
2	1.7 (0.9, 5.4)
3 = Mid 20%	1.0
4	1.9 (0.8, 4.8)
5 = Highest 20%	3.3 (1.3, 7.9)†
Training Unit	
Low Mileage	1.0
High Mileage	1.6 (0.9, 2.7)

n = 303 men in Army infantry initial entry training, Fort Benning, GA, 1987.

* An odds ratio is a surrogate for a risk ratio and generally overestimates risk. It is used when a rate cannot be calculated.

† p ≤ 0.05 for odds ratio (comparison to baseline; baseline = factor with odds ratio of 1.0).

Source: Jones, B.H., D.N. Cowan, J.P. Tomlinson, et al. "Epidemiology of Injuries Associated with Physical Training Among Young Men in the Army." *Med. Sci. Sports Ex.* 25(2):197-203, 1993.

In the early 1990s, injuries among military parachutists were targeted for prevention. Ankle injuries associated with the forces of parachute landings were of particular concern. After an assessment of the general characteristics of and risk factors for these injuries, an off-the-shelf device, the parachute ankle brace (PAB), was chosen for a randomized injury intervention trial. This simple device was highly efficacious in reducing ankle sprains and also quite cost effective. Results of the first study* revealed:

- The incidence of inversion ankle sprains was 1.9% in non-brace wearers and 0.3% in brace wearers.
- Other injuries appeared unaffected by the brace.

The Army estimates that cost avoidance using these braces will be on the order of \$2.5 million per year. The success of this intervention represents a good example of the benefits of a methodical and scientific approach to injury control.

* Amoroso, Paul J. et al. "Braced for Impact: Reducing Military Paratroopers' Ankle Sprains Using Outside-the-Boot Braces." *Journal of Trauma: Injury, Infection, and Critical Care* 45(3):575-580, 1998.

Table 6-10 displays the frequency of diagnosis codes for outpatient visits for active duty Army personnel at Fort Eustis, Virginia, from June 1996 to May 1997. The top five diagnosis codes for outpatient visits were:

- V codes—35% (16,429 visits).
- Musculoskeletal system—17.1% (8,026 visits).
- Injury—10.9% (5,108 visits).
- Respiratory system—6.7% (3,131 visits).
- Infectious and parasitic—5.2% (2,461 visits).

Injuries are not the only cause of concern in the basic training environment. However, in this population of active duty Army personnel, injury and musculoskeletal system conditions account for 28% of all outpatient visits.

Data are as reported in the Standard Ambulatory Data Record (SADR) from the Ambulatory Data System (ADS), which has not been fully implemented. Therefore, the data provided represent less than 50% of the total encounters. In the SADR, there are one to four diagnosis codes for each encounter. Each diagnosis code was counted, which means a single encounter may be counted up to four times.

Table 6-10. Army - Frequency of Outpatient Visits* by Principal Diagnosis Groups for Active Duty Personnel, June 1996 - May 1997

Principal Diagnosis Groups	ICD-9 Codes	Frequency of Visits	Percentage
V Codes	V01-V82	16,429	35.0%
Musculoskeletal System	710-739	8,026	17.1%
Injury	800-999	5,108	10.9%
Respiratory System	460-519	3,131	6.7%
Infectious & Parasitic	001-139	2,461	5.2%
Mental Disorders	290-319	2,273	4.8%
Nervous System	320-389	2,055	4.4%
Genitourinary System	580-629	1,936	4.1%
Ill-Defined Conditions	780-799	1,393	3.0%
Skin Diseases	680-709	1,316	2.8%
Digestive System	520-579	1,254	2.7%
Circulatory System	390-459	586	1.2%
Endocrine, Nutritional, & Metabolic	240-279	560	1.2%
Neoplasms	140-239	205	0.4%
Congenital Anomalies	740-759	127	0.3%
Blood & Blood Forming Organs	280-289	70	0.1%
Pregnancy	630-676	10	0.0%
Perinatal Period Conditions	760-779	2	0.0%
E Codes	E800-E999	2	0.0%
Total	—	46,944	99.9%

n (approximate) = 4,667.

* Outpatient clinics at McDonald Army Community Hospital, Fort Eustis, VA.

Source: SADR, Patient Administration Systems Biostatistics Activity.

6-6. Navy and Marine Corps

The medical research and surveillance of injuries in the Navy and Marine Corps has most thoroughly been applied to training populations where the impact of injuries is the greatest. This is due to the nature of military training which includes limited numbers of personnel going through high intensity activity, compressed into the shortest possible period of time. Any disruption of this process results in the inability to enroll new trainees, the interruption of an individual's progress, and an inability to fill operational personnel needs.

The Navy trains approximately 50,000 recruits per year (42,000 men and 8,000 women), and the Marine Corps trains approximately 42,000 recruits per year (40,000 men and 2,000 women). Other training programs which have a high impact from injuries are Marine Corps Officer Candidate training and basic underwater demolition/SEALS (BUD/S). These programs are very safe and result in few acute accidental injuries. The majority of the injuries are lower extremity overuse injuries, secondary to a dramatic change in physical activity. (Recent efforts have begun on a large scale attempt to transfer the technology developed to reduce injuries in training populations to the operational forces.)

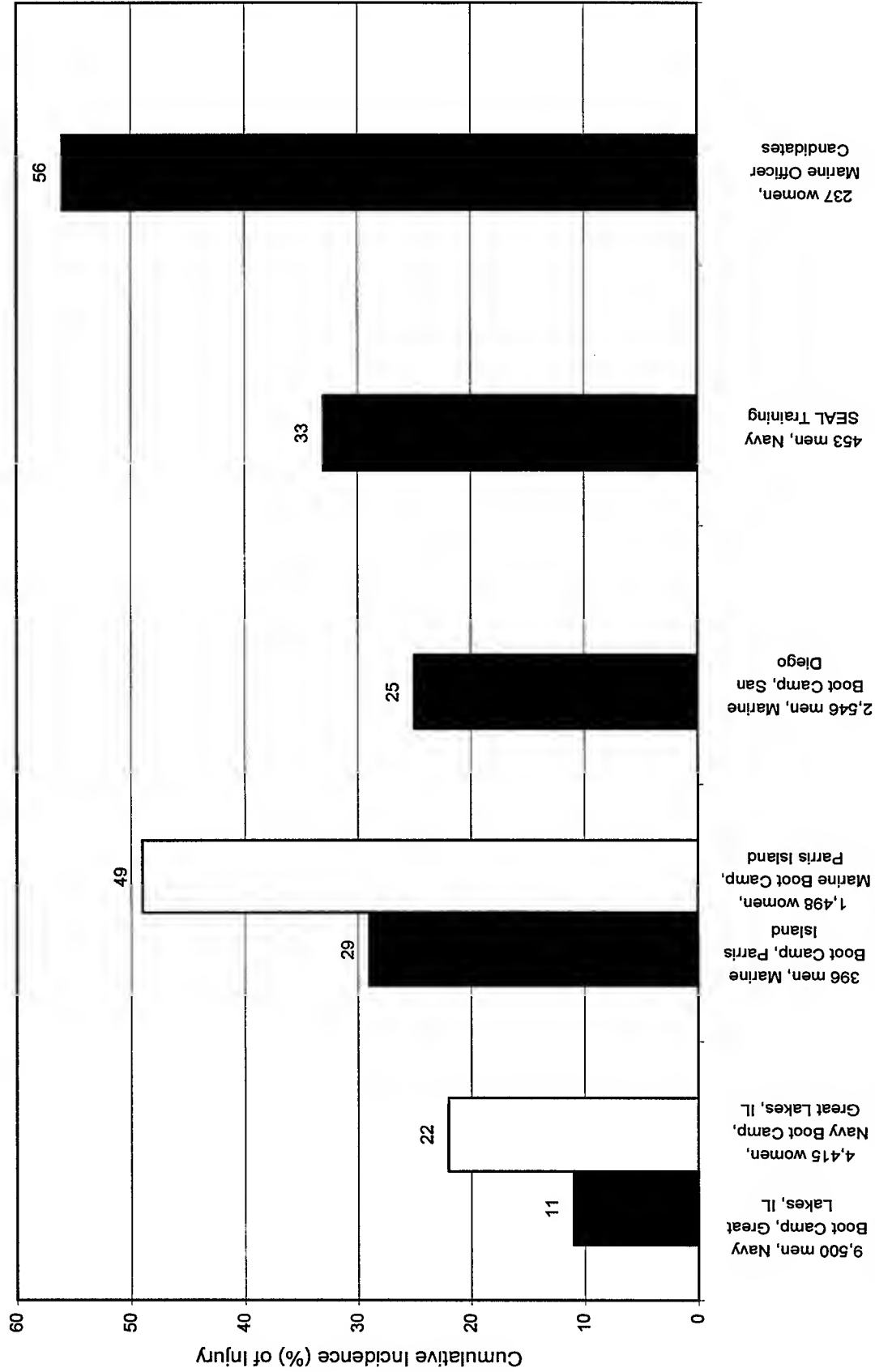
The Navy and Marine Corps data are presented in three parts:

- Incidence of injury is discussed on pages 6-56 through 6-63.
- Relative risks of injury/illness and rates of limited duty are discussed on pages 6-68 and 6-71.
- Risk factors are discussed on pages 6-72 through 6-83.

Incidence of Injury.

Figure 6-14 illustrates the incidence of injury among selected Navy and Marine Corps personnel during training in 1995. The percentage of trainees with at least one injury during training is directly related to the intensity of the training program. The length of each training program is varied: BUD/S is 24 weeks, Marine Corps recruit training is 11 weeks for men and 13 weeks for women, Navy basic training is 9 weeks, and Marine Corps Officer Candidate School is 10 weeks.

Navy and Marine Corps - Incidence (%) of Injury Among Selected Personnel During Training, 1995



Source: Naval Health Research Center, personal communication, 1996.

Figure 6-14

Table 6-11 displays the cumulative incidence of the most common injury diagnoses among men and women in Navy recruit training in 1996.

- Overuse injuries account for five of the top seven injury diagnoses.
- For both men and women, metatarsalgia is the most common injury diagnosis in recruit training.

Table 6-11. Navy - Cumulative Incidence (%) of the Most Common Injury Diagnoses Among Men and Women in Recruit Training,* 1996

Injury Diagnoses	Men Incidence (%)	Women Incidence (%)	Risk Ratio (women vs. men)
Metatarsalgia	2.3%	7.8%	3.4
Patellofemoral Syndrome	2.0%	3.3%	1.6
Ankle Sprain	1.8%	6.0%	3.3
Back Pain	1.6%	—	—
Plantar Fasciitis	1.3%	6.6%	5.1
Tendinitis - Ankle/Foot	1.3%	4.8%	3.7
Stress Fracture - Lower Extremity	0.8%	3.0%	3.7

n = not available.

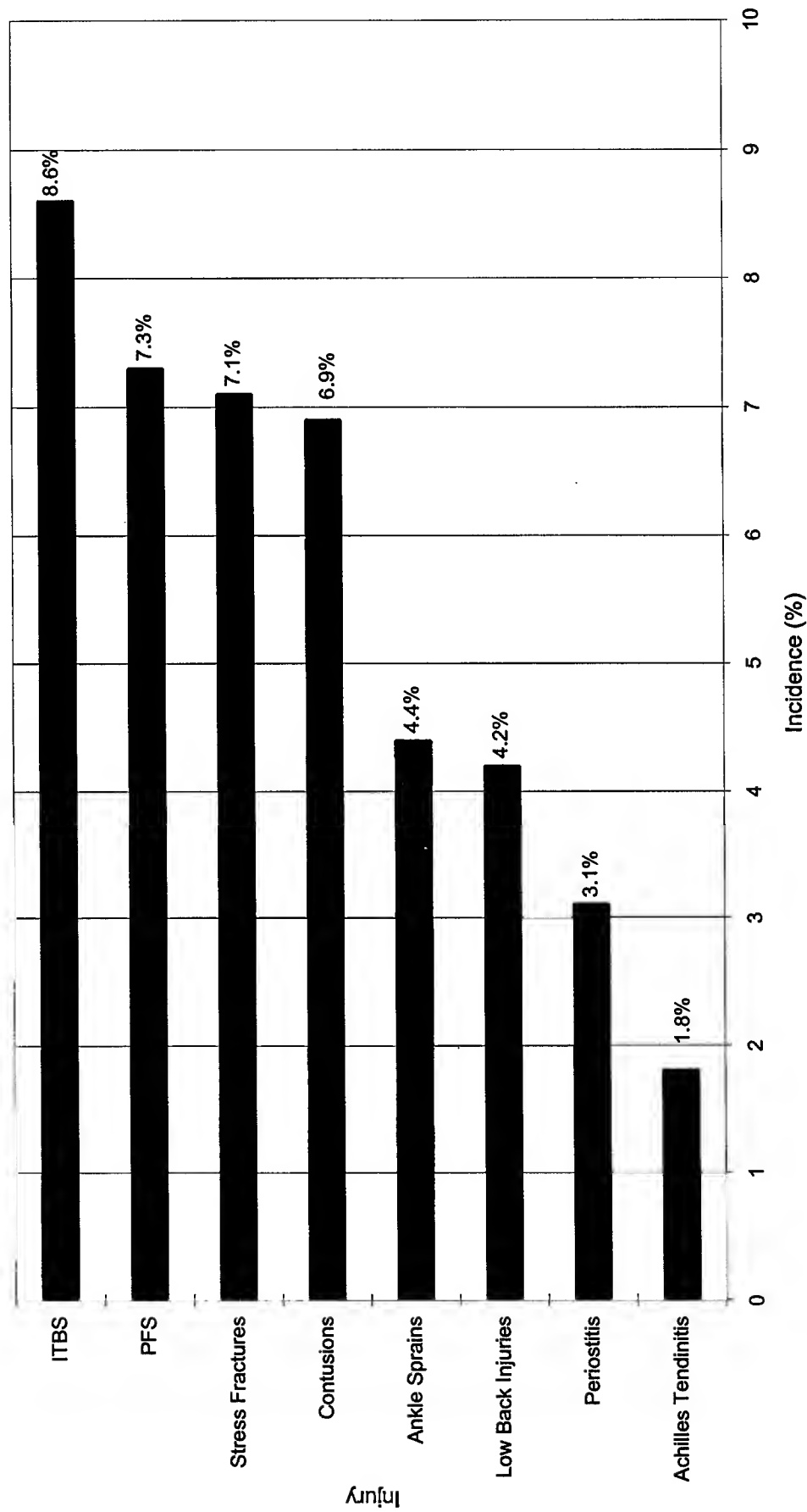
* 9 weeks, Great Lakes, IL.

Source: Naval Health Research Center, personal communication, 1997.

Figure 6-15 illustrates the most common musculoskeletal injury diagnoses among Navy SEAL trainees from May 1933 through June 1995.

- Iliotibial band syndrome (ITBS) was the most common injury diagnosis.
- Five of the top eight injury diagnoses were overuse injuries.

Navy - Most Common Musculoskeletal Injuries Among SEAL Trainees, May 1993 - June 1995



n = 451.

Source: Naval Health Research Center, personal communication, 1997.

Figure 6-15

Table 6-12 displays the most common injury diagnoses among men in Marine Corps recruit training in 1995.

- Ankle sprains were the most common injury during recruit training.
- Overuse injuries accounted for four of the top eight injuries for men.

Table 6-12. Marine Corps - Cumulative Incidence (%) of the Most Common Injury Diagnoses Among Men in Recruit Training,* 1995

Injury Diagnoses	Incidence (%)
Ankle Sprains	6.6%
Blister	6.0%
Cellulitis - Ankle/Foot	3.0%
Stress Fractures	2.2%
Iliotibial Band Syndrome	1.8%
Foot Pain	1.7%
Achilles Tendinitis	1.5%
Strain/Sprain - Knee/Leg	1.3%

n = 1,322 men.

* 11 weeks, Marine Corps Recruit Depot, San Diego, CA.

Source: Naval Health Research Center, personal communication, 1997.

Table 6-13 displays the cumulative incidence (%) of the most common injury diagnoses among women in Marine Corps recruit training in 1995.

- Ankle sprains were the most common injury during recruit training.
- Overuse injuries accounted for seven of the top eight injuries for women.

Table 6-13. Marine Corps - Cumulative Incidence (%) of the Most Common Injury Diagnoses Among Women in Recruit Training,* 1995

Injury Diagnoses	Incidence (%)
Ankle Sprains	8.7%
Shin Splints	5.9%
Stress Fractures	5.2%
Patellofemoral Syndrome	4.5%
Tendinitis - Ankle/Foot	4.1%
Patellar Tendinitis	3.8%
Iliotibial Band Syndrome	2.6%
Plantar Fasciitis	2.4%

n = 1,498 women.

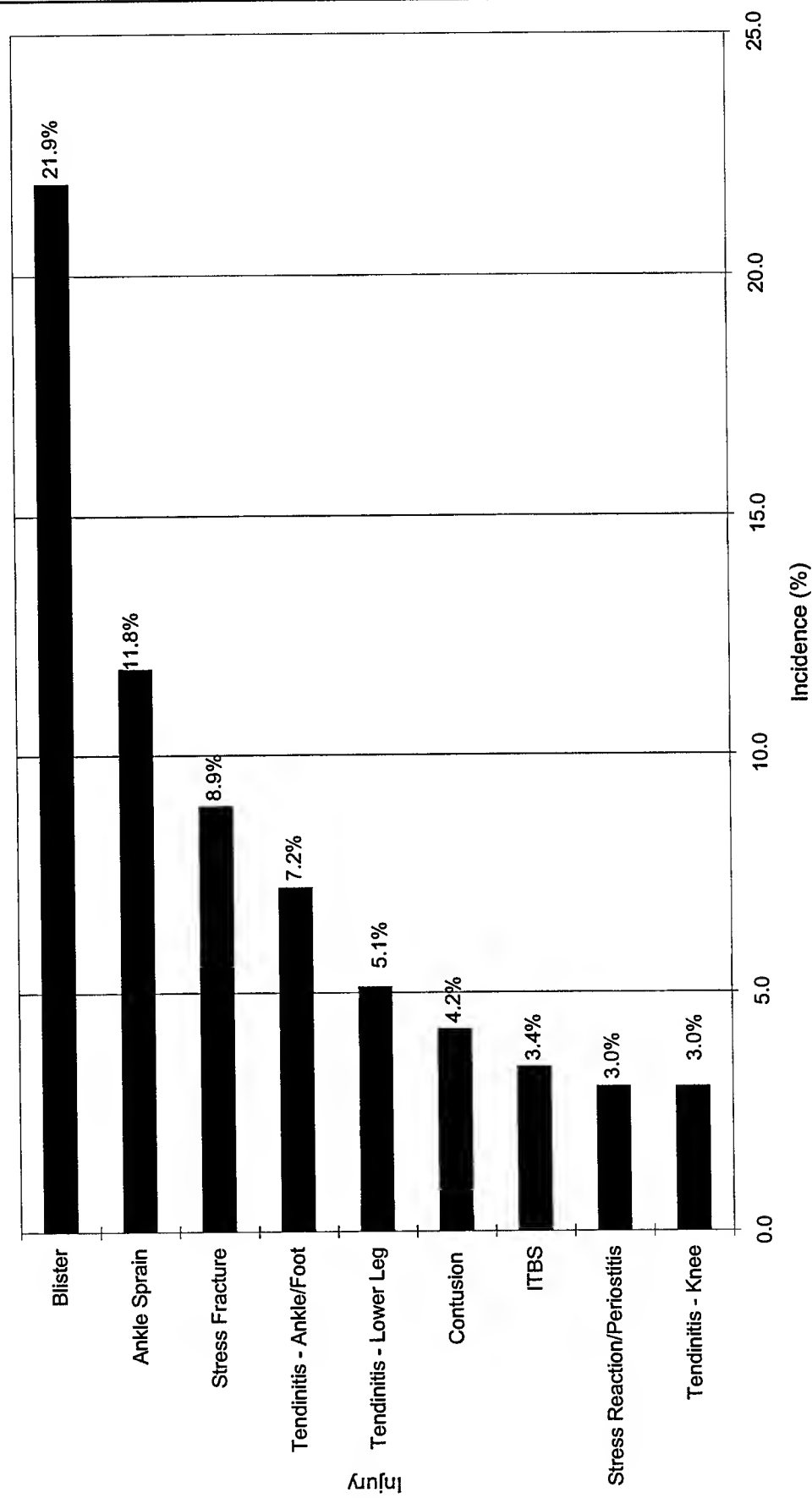
* 13 weeks, Marine Corps Recruit Depot, Parris Island, SC.

Source: Naval Health Research Center, personal communication, 1997.

Figure 6-16 illustrates the most common injury diagnoses among female officer candidates from 1994 through 1995.

- Blisters were the most common injury sustained among women during officer candidate training.
- Six of the top nine injury diagnoses were overuse injuries.

Marine Corps - Top Musculoskeletal Injuries among Female Officer Candidates, 1994 - 1995



n = 237.

Source: Naval Health Research Center, personal communication, 1997.

Figure 6-16

Relative Risks of Injury/Illness.

Table 6-14 displays the rates of injury and illness among men and women in Marine Corps recruit training in 1993.

- Women experienced twice the rate of injury clinic visits during recruit training compared to men.
- During recruit basic training, men experienced 40% fewer injury visits than for illness.
- During recruit basic training, the sick call rates for women were the same for injury and illness.

Table 6-14. Marine Corps - Rates of Injury and Illness Among Men and Women in Recruit Training,* 1993

Type	Rate (n/100/mo)		Rate Ratio†
	Injury	Illness	
≥ One sick call visit - Men	8.3	13.9	0.60
≥ One sick call visit - Women	16.3	16.3	1.0

n (men) = 434; n (women) = 366.

* 11 weeks for men and 13 weeks for women, Marine Corps Recruit Depot, Parris Island, SC.

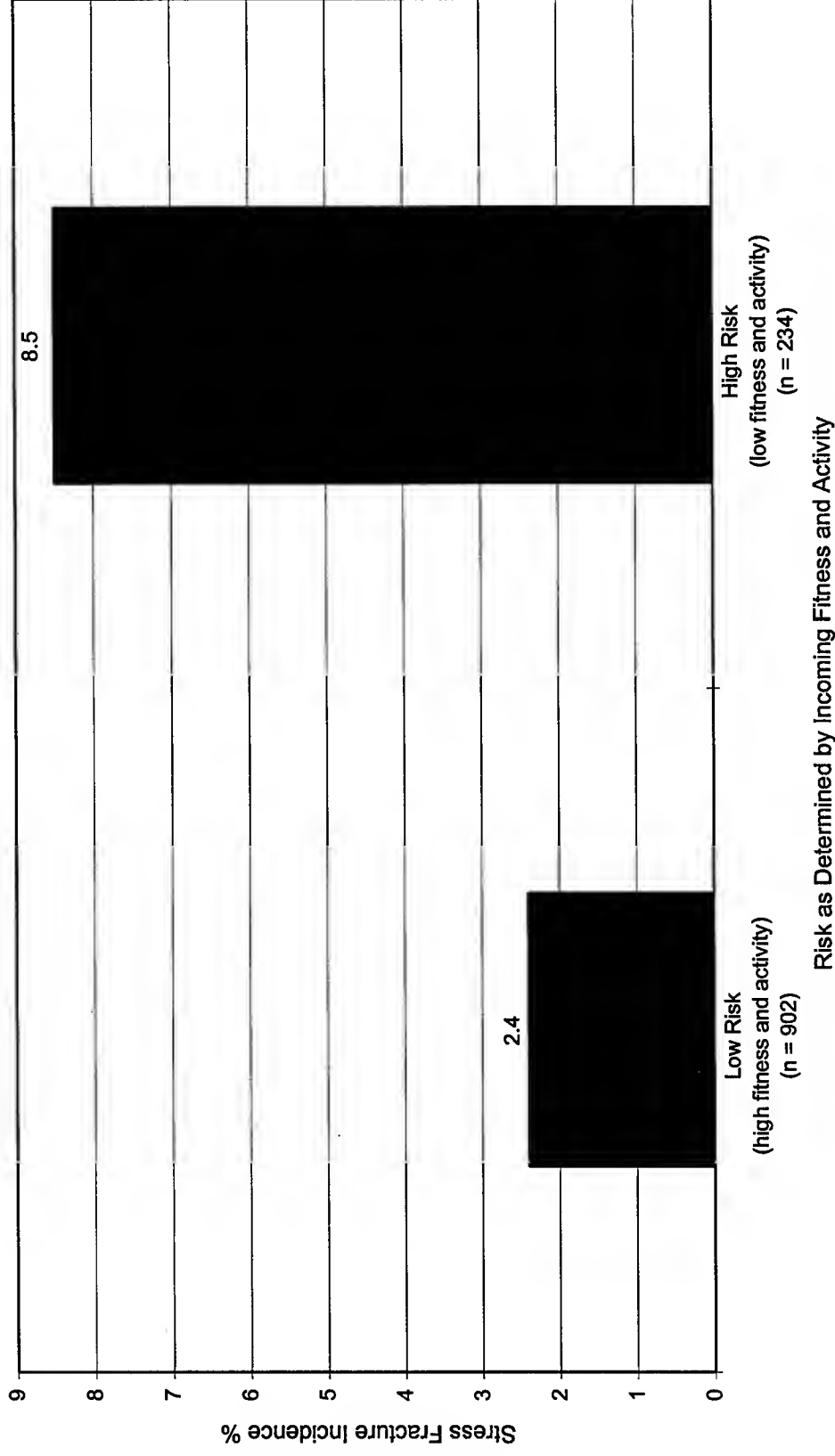
† Rate ratio = injury rate/illness rate.

Source: Kimsey, C.D., Jr. The Epidemiology of Lower Extremity Injuries in U.S. Marine Corps Recruits. Doctoral thesis, University of South Carolina School of Public Health, 1993.

Figure 6-17 illustrates the stress fracture incidence among male Marine Corps recruits in 1994 according to incoming physical fitness and recent physical activity.

- Recruits were classified as either high or low risk for stress fracture based on their response to five self-reported questions about physical activity and the time from a maximal effort 1.5 mile run upon arrival at training.
- High-risk recruits, who were the least physically active prior to training, and ran slower than an 8-minute mile upon arrival at training, were 3.5 times more likely to develop a stress fracture during training.

Marine Corps - Incidence of Stress Fracture Among Physical Fitness*/ Activity Categories in Men in Recruit Training, 1994



n = 1,136.

Risk ratio (faster vs. slower) = 3.5; confidence interval = 1.95 - 6.61.

* Fitness as measured by questionnaire and run time.

Source: Shaffer, R.A.; Brodine, S.K.; Almeida, S.A.; Williams, K.M.; Ronaghy, S. 1999. "Use of Simple Measures of Physical Activity to Predict Stress Fractures in Young Men Undergoing a Rigorous Physical Training Program." *Am. J. Epidemiology* 149(3):236-242.

Figure 6-17

Risk Factors.

Table 6-15 displays the evaluation of mileage, stress fracture incidence, and final fitness among men in Marine Corps recruit training in 1995.

- The improvement in aerobic performance, or run time, with increased mileage was not substantial.
- The incidence of stress fractures slightly increased as distance run increased.

Table 6-15. Marine Corps - Evaluation of Mileage, Stress Fracture Incidence, and Final Fitness Among Men in Recruit Training, * 1995

Subjects (n)	Distance Run* (miles)	Stress Fracture (%)	Final 3-Mile Run Time (Mean)
1,136	55	3.7%	20:20
1,117	41	2.7%	20:44
1,097	33	1.7%	20:53

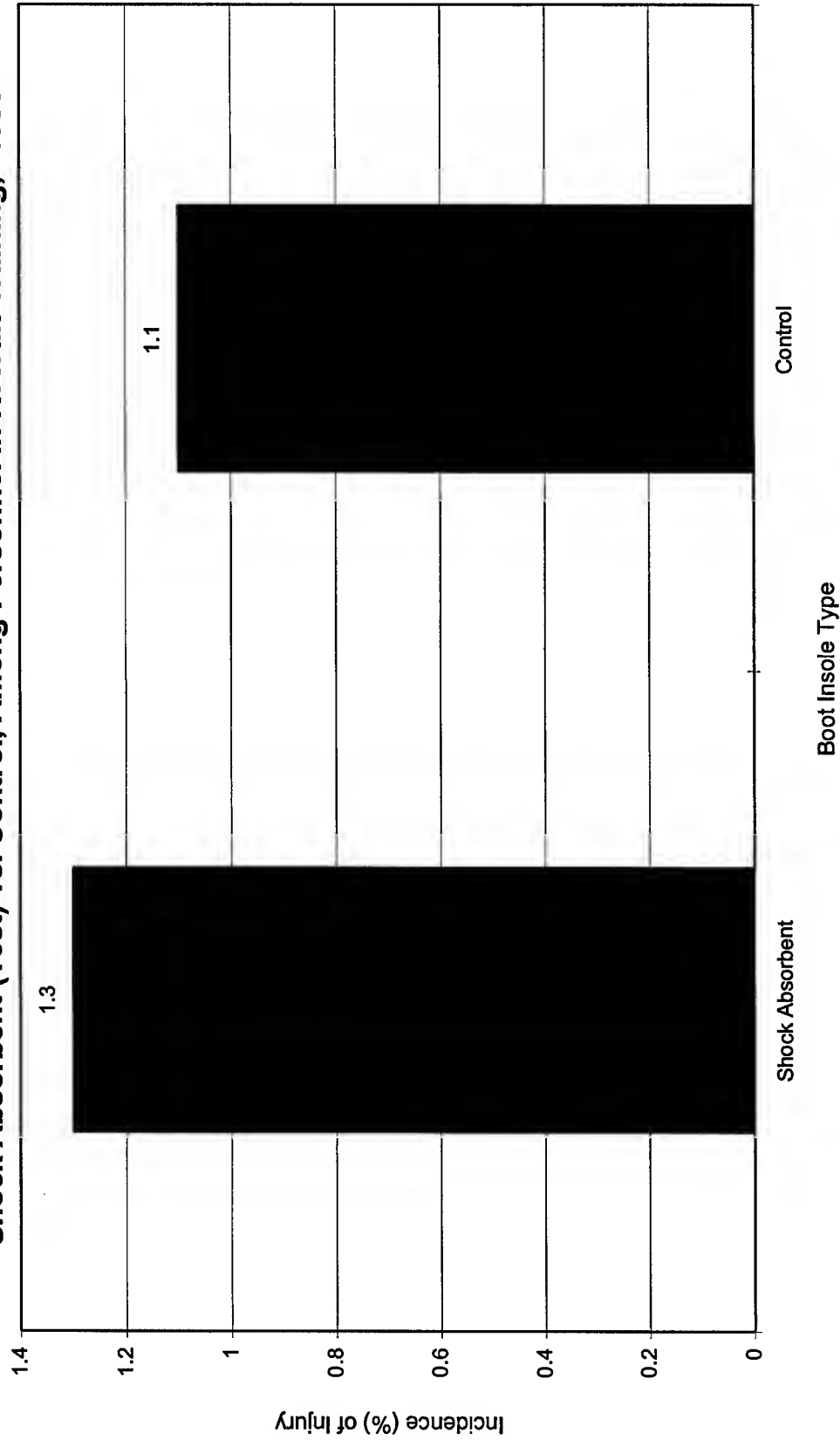
* Total organized running during recruit training, 11 weeks.

Source: American College of Sports Medicine 43rd annual meeting, "The Epidemiology of Fitness, Training, and Exercise-Related Injuries: A Military Perspective," Cincinnati, Ohio, June 1996.

Figure 6-18 illustrates the incidence of injury for stress fractures by insole type, shock absorbent (test) versus control, among personnel in Marine Corps recruit training in 1985.

- This is an example of a study that modified an extrinsic factor (footwear) in order to prevent injuries.
- In this study, incidence of stress fractures was not decreased with use of a shock-absorbent insole.

Marine Corps - Incidence (%) of Injury for Stress Fractures by Insole Type, Shock Absorbent (Test) vs. Control, Among Personnel in Recruit Training,* 1985



n = 3,025 (1,555 test, 1,470 control).
 * 12 weeks. Marine Corps Recruit Depot, Parris Island, SC.
 Risk ratio = (test/control) = 1.17, p = n.s.

Source: Gardner LI, et.al. Prevention of Lower Extremity Stress Fractures: A Controlled Trial of a Shock Absorbent Insole. Am J Public Health, 78:1563-1567, 1988.

Figure 6-18

Table 6-16 displays the associations of personal characteristics and smoking with lower extremity musculoskeletal injuries for men in Marine Corps recruit training in 1993.

- Among the 434 men studied, smoking history showed the strongest and the only statistically significant association with injury compared to other personal characteristics.

Table 6-16. Marine Corps - Associations of Personal Characteristics and Smoking with Lower Extremity Musculoskeletal Injury Among Men in Recruit Training,* 1993

Variables	Odds Ratio†	95% Confidence Interval
Age (1 year)	1.18	0.97, 1.43
Ethnicity		
Black	1.00	—
White	1.07	0.58, 1.98
Other	1.59	0.61, 4.15
Body Mass Index		
Q1 (lowest)	1.00	—
Q2	0.66	0.34, 1.29
Q3	0.94	0.50, 1.79
Q4 (highest)	0.83	0.43, 1.58
Arch Type		
Normal	1.00	—
Not Normal	1.08	0.63, 1.86
Smoking History (past 12 months)		
No	1.00	—
Yes	2.25	1.45, 3.50‡
Number Cigarettes Smoked		
1-9	1.00	—
≥ 10	0.82	0.39, 1.75

n = 434.

* 11 weeks, Marine Corps Recruit Depot, Parris Island, SC.

† An odds ratio is a surrogate for a risk ratio and generally overestimates risk. It is used when a rate cannot be calculated.

‡ Significant $p < .05$.

Source: Kimsey, C.D., Jr. The Epidemiology of Lower Extremity Injuries in U.S. Marine Corps Recruits. Doctoral thesis, University of South Carolina School of Public Health, 1993.

Table 6-17 displays the associations of personal characteristics and smoking with lower extremity musculoskeletal injuries among women in Marine Corps recruit training in 1993.

- Among the 366 women studied, smoking history showed the strongest and the only statistically significant association with injury compared to other personal characteristics.

Table 6-17. Marine Corps - Associations of Personal Characteristics and Smoking with Lower Extremity Musculoskeletal Injury Among Women in Recruit Training,* 1993

Variables	Odds Ratio†	95% Confidence Interval
Age (1 year)	0.96	0.85, 1.09
Ethnicity		
Black	1.00	—
White	1.27	0.68, 2.36
Other	1.11	0.54, 2.99
Body Mass Index		
Q1 (lowest)	1.00	—
Q2	0.93	0.48, 1.81
Q3	0.96	0.49, 1.86
Q4 (highest)	0.82	0.42, 1.60
Arch Type		
Normal	1.00	—
Not Normal	1.37	0.79, 2.37
Smoking History (past 12 months)		
No	1.00	—
Yes	1.74	1.09, 2.76‡
Number Cigarettes Smoked		
1-9	1.00	—
≥ 10	1.17	0.53, 2.59
Regular Menstrual Periods		
Yes	1.00	—
No	0.98	0.61, 1.57

n = 366.

* 13 weeks, Marine Corps Recruit Depot, Parris Island, SC.

† An odds ratio is a surrogate for a risk ratio and generally overestimates risk. It is used when a rate cannot be calculated.

‡ Significant $p < .05$.

Source: Kimsey, C.D., Jr. The Epidemiology of Lower Extremity Injuries in U.S. Marine Corps Recruits. Doctoral thesis, University of South Carolina School of Public Health, 1993.

Table 6-18 displays a regression model for the relationship between initial fitness and lower extremity musculoskeletal injury among men in Marine Corps recruit training in 1993.

- Run time on the initial physical fitness test, smoking history, and exercise level prior to boot camp were predictors of lower extremity musculoskeletal injury risk among these recruits.

Table 6-18. Marine Corps - Association* Between Initial Fitness and Lower Extremity Musculoskeletal Injury Among Men in Recruit Training,† 1993

Variables	Odds Ratio	95% Confidence Interval
Initial fitness (first run time)		
Q1 (fastest)	1.00	—
Q2	2.07	1.02, 4.18
Q3	1.26	0.60, 2.64
Q4 (slowest)	2.11	1.05, 4.26
Smoking History (smoked in past 12 months)		
no	1.00	—
yes	2.09	1.29, 3.37
Exercise Change Prior to Boot Camp		
exercised more	1.00	—
maintained same amount or decreased	1.70	1.02, 2.83
Past exercise injury		
no	1.00	—
yes	1.56	0.96, 2.54

n = 369 men.

* Full model also included physical activity history, age, body mass index, ethnicity, occupational activity, exercise, exercise intensity, and self-rated fitness, none of which were significant predictors of injury.

† 11 weeks, Marine Corps Recruit Depot, Parris Island, SC.

Source: Kinney, C.D., Jr. The Epidemiology of Lower Extremity Injuries in U.S. Marine Corps Recruits. Doctoral thesis, University of South Carolina School of Public Health, 1993.

Table 6-19 displays a regression model for the relationship between initial fitness and lower extremity musculoskeletal injury among women in Marine Corps recruit training in 1993.

- The only predictor of injury for women in Marine Corps recruit training was initial run time.
- Women demonstrating low aerobic fitness (as measured by run time) on the initial physical fitness test were at increased risk of injury.

Table 6-19. Marine Corps - Association* Between Initial Fitness and Lower Extremity Musculoskeletal Injury Among Women in Recruit Training,† 1993

Variables	Odds Ratio†	95% Confidence Interval
Initial fitness (first run time)		
Q1 (fastest)	1.00	—
Q2	2.18	1.07, 4.43
Q3	2.17	1.05, 4.45
Q4 (slowest)	2.44	1.18, 5.07

n = 265 women.

* Full model also included physical activity history, age, body mass index, smoking history, ethnicity, past exercise/sports exercise intensity, self-rated fitness, and regular menstrual periods, none of which were significant predictors of injury. † 13 weeks, Marine Corps Recruit Depot, Parris Island, SC.

† An odds ratio is a surrogate for a risk ratio and generally overestimates risk. It is used when a rate cannot be calculated. Source: Kimsey, C.D., Jr. The Epidemiology of Lower Extremity Injuries in U.S. Marine Corps Recruits. Doctoral thesis, University of South Carolina School of Public Health, 1993.

6-7. Air Force

The Air Force data are presented in two parts:

- Incidence of injury is discussed on pages 6-84 and 6-85.
- Relative risks of injury/illness are discussed on pages 6-86 through 6-89.

Incidence of Injury.

Table 6-20 displays the cumulative incidence of injuries among Air Force men and women in basic training in 1995.

- Female recruits had more than twice the incidence of injury compared to male recruits.

Table 6-20. Air Force - Cumulative Incidence (%) of Injuries Among Men and Women in Basic Training,* 1995

	Men (n = 8,656)		Women (n = 5,250)	
	Percentage	95% Confidence Interval	Percentage	95% Confidence Interval
Injured at least once	15.0%	14.2, 15.7	32.8%	31.5, 34.0

* 6 weeks, Lackland AFB, TX.

Source: Snedecor, M.R.; Boudreau, C.F.; Ellis, B.E.; Roth, L.M.; Schulman, J. 1996. Injury and Illness Among Air Force Military Recruits. Office for Prevention and Health Services Assessment (OPHSA), Brooks AFB, TX. DTIC # ADA 327527.

Relative Risks of Injury/Illness.

Table 6-21 displays the rates of injury and illness among men and women in Air Force basic training in 1995.

- Female recruits had more than twice the risk of injury compared to male recruits.
- Female recruits had a 60% greater risk of illness compared to male recruits.
- Knee injuries and blisters ranked as one of the top three injury rates for both men and women.
- Respiratory condition rates were considerably higher than other illness rates for both men and women.

Table 6-21. Air Force - Rates of Injury and Illness Among Men and Women in Basic Training,* 1995

Injuries/Illnesses	Men (n = 8,656)		Women (n = 5,250)	
	Rate (n/1,000/week)	95% Confidence Interval	Rate (n/1,000/week)	95% Confidence Interval
All Encounters	65.0	63.2, 66.9	109.5	106.9, 112.1
All Injuries	27.8	26.4, 29.2	63.0	60.6, 65.5
Specific Injuries				
Blisters	5.8	5.1, 6.5	15.9	14.5, 17.3
Trunk/back/neck/chest/shoulder/arms	5.0	4.4, 5.7	9.2	8.1, 10.3
Knee injuries	4.9	4.3, 5.6	12.2	11.0, 13.5
Ankle and foot, excluding blisters	4.8	4.2, 5.4	16.7	15.2, 18.1
Hip and other leg injuries	2.6	2.1, 3.0	7.6	6.6, 8.6
Lacerations and contusions	2.5	2.1, 3.0	5.8	4.9, 6.7
All Illnesses	48.8	47.1, 50.5	77.9	75.4, 80.5
Specific Illnesses				
Respiratory conditions	30.0	28.6, 31.5	41.9	39.8, 44.1
Dermatological	9.5	8.6, 10.3	14.9	13.5, 16.2
Gastrointestinal	4.6	4.0, 5.2	12.0	10.8, 13.3
Psychological	2.4	2.0, 2.8	4.8	4.0, 5.7

* 6 weeks, Lackland AFB, TX.

Source: Snedecor, M.R.; Boudreau, C.F.; Ellis, B.E.; Roth, L.M.; Schulman, J. 1996. Injury and Illness Among Air Force Military Recruits. Office for Prevention and Health Services Assessment (OPHSA), Brooks AFB, TX. DTIC # ADA 327527.

Table 6-22 displays the distribution of the top 10 injuries among men and women in Air Force basic training in 1995.

- The highest percentage of injury clinic visits were due to blisters and knee pain for both men and women.
- Eight out of the top 10 injuries were lower extremity injuries.

Table 6-22. Air Force - Frequency and Distribution (%) of Top 10 Injuries Among Men and Women in Basic Training,* 1995

Injuries	Men (n = 1,329 injury visits)			Women (n = 1,743 injury visits)			Total (n = 3,072 injury visits)		
	Number of Visits	% of Injury Visits	Rank	Number of Visits	% of Injury Visits	Rank	Number of Visits	% of Injury Visits	Rank
Blisters - foot	325	24.5%	1	481	27.6%	1	806	26.2%	1
Joint/muscle/other pain - knee	201	15.1%	2	263	15.0%	2	464	15.1%	2
Sprains/strains - ankle	111	8.4%	4	197	11.3%	3	308	10.0%	3
Joint/muscle/other pain - ankle/foot	95	7.1%	5	190	10.9%	4	285	9.3%	4
Inflammation - ankle/foot	62	4.7%	9	151	8.7%	5	213	6.9%	5
Sprains/strains - shin splints/lower leg	75	5.6%	7	138	7.9%	6	213	6.9%	6
Joint/muscle/other pain - back	121	9.1%	3	84	4.8%	9	205	6.7%	7
Sprains/strains - knee	77	5.8%	6	107	6.1%	7	184	6.0%	8
Sprains/strains - trunk, back, neck	66	5.0%	8	105	6.0%	8	171	5.6%	9
Lacerations/contusions - lower limbs	58	4.4%	10	76	4.3%	10	134	4.4%	10

* 6 weeks, Lackland AFB, TX.

Source: Snedecor, M.R.; Boudreau, C.F.; Ellis, B.E.; Roth, L.M.; Schulman, J. 1996. Injury and Illness Among Air Force Military Recruits. Office for Prevention and Health Services Assessment (OPHSA), Brooks AFB, TX. DTIC # ADA 327527.

CHAPTER 7

DEFENSE AND VETERANS HEAD INJURY PROGRAM: A MODEL INJURY REGISTRY

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Section I. Description of Defense and Veterans Head Injury Program

7-1. Introduction

Overall management of the Defense and Veterans Head Injury Program (DVHIP) and centralized data collection and analysis are conducted by the DVHIP central office, Washington, D.C.; Henry M. Jackson Foundation, Rockville, Maryland; and the Uniformed Services University of the Health Sciences, Bethesda, Maryland, in close collaboration with the Department of Veterans Affairs (DVA), Washington, D.C., and the Brain Injury Association (BIA), Alexandria, Virginia.

7-2. Mission

The DVHIP represents a unique collaboration of the DoD, DVA, and BIA. The DVHIP's mission is to ensure that all military and DVA traumatic brain (head) injury (TBI) patients receive TBI-specific evaluation and follow-up, while at the same time collecting standardized patient outcome data. This data collection allows for the comparison of the efficacy and cost of various TBI treatment and rehabilitation strategies, and helps define optimal care for victims of TBI. The DVHIP mission is guided by three chief principles:

- "Learn as We Treat" integrates clinical care and clinical research.
- "Dual Use Concept" provides the unique potential of DoD and DVA care systems.
- "Inter- and Intra-Agency Collaboration" increases efficiency.

7-3. Purpose

The DVHIP's purpose is to treat and evaluate active duty military personnel and veterans with TBI. The DVHIP also performs outcome-based research related to TBI recovery using the "Learn as We Treat" model.

7-4. Authority

The DVHIP conducts its surveillance under the authority of the U.S. Congress and DoD Health Affairs.

7-5. The Defense and Veterans Head Injury Program and Data

Program. The DVHIP consists of five major components:

- A regional network of three military and four Veterans Administration (VA) hospitals:
 - Walter Reed Army Medical Center, Washington, D.C.
 - Wilford Hall Air Force Medical Center, San Antonio, Texas.
 - San Diego Naval Medical Center, San Diego, California.
 - Palo Alto Veterans Administration Medical Center, Palo Alto, California.
 - Richmond Veterans Administration Medical Center, Richmond, Virginia.
 - Tampa Veterans Administration Medical Center, Tampa, Florida.
 - Minneapolis Veterans Administration Medical Center, Minneapolis, Minnesota.
- A secondary network of 20 DVA hospitals affiliated with these primary centers also exists.
- Standardized patient evaluations and database including clinical reports and descriptive studies.
- Clinical treatment trials, including:
 - A study of the impact of “mild” TBIs on performance (San Diego Naval Medical Center).
 - A randomized controlled study of home versus institutional rehabilitation for soldiers with “moderate” TBIs (Walter Reed Army Medical Center).
 - A randomized controlled multicenter study of cognitive vs. functional rehabilitation with adjunct pharmacotherapy or placebo in “severe” TBIs (i.e., acute management in the field) (DVHIP veterans hospitals).
- Education programs (e.g., patient “Helpline,” TBI Resource Center, etc.).
- Prevention programs (e.g., BIA “Headsmart”).

Data. DVHIP data collection includes a one-page registry form, as well as the more extensive standardized multidisciplinary evaluation data collected at the lead TBI centers as a part of treatment and evaluation studies. In addition, a one-page combat head and spinal injury registry form was developed based on the Vietnam head injury study and was used during the Gulf War. The registries serve not only as epidemiologic tools, but also as recruiting tools that help identify TBI survivors requiring further treatment and follow-up in the DVHIP.

7-6. The Defense and Veterans Head Injury Program Database and Minimum Basic Data Set Variables

The DVHIP database variables were compared to the MBDS for *unintentional* injury surveillance recommended by Lund.¹ The comparison displayed in Table 7-1 shows that the DVHIP variables fulfilled *all* of the MBDS requirements.

Additional data required to satisfy the MBDS for *intentional* injuries² include circumstances or motive surrounding injury event, drugs or alcohol involved, weapon(s) involved, relationship and demographics of victim to perpetrator, source of data, and intent. The DVHIP database includes information on the weapon(s) involved and the intent.

¹ Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994.

² Powell, K. and J. Kraus. Minimum Basic Data Set, Intentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:35-1 to 35-2, 1994.

Table 7-1. Comparison of the Recommended Elements for the Minimum Basic Data Set Variables for Unintentional Injury Surveillance to the Defense and Veterans Head Injury Program

Variables	Defense and Veterans Head Injury Program
Intent*	Y
Age of Injured*	Y
Gender*	Y
Race*	Y
Place of Residence*	Y
Date of Injury Event*	Y
Place of Occurrence (e.g., home, work, etc.)*	N
Address of Place of Occurrence*	Y
Activity When Injury Occurred*	Y
Mechanism of Accident/Event*	Y
Type of Injury/Body Location*	Y
Outcome of Injury	
Type of Treatment†	Y
Dates of Treatment†	Y
Date Admitted to Hospital†	Y

Table 7-1. --Continued

Variables	Defense and Veterans Head Injury Program
Date Discharged from Hospital†	Y
Nature of Disability†	Y
Degree of Disability (e.g., fit for duty, TDRL, etc.)†	Y
Severity of Injury†	Y
Days of Limited Duty†	Y
Days in Hospital†	Y
Costs of Treatment†	Y

Y = available in database.

* Recommended variables for databases designed for unintentional injury surveillance (Lund J., Y. Holder, and R.J. Smith. Minimum Basic Data Set, Unintentional Injuries. *Proceedings of the International Collaborative Effort on Injury Statistics*, 1:34-1 to 34-4, 1994).

† Example of an outcome variable deemed appropriate for databases with potential for surveillance of unintentional injuries.

Section II. Military Traumatic Brain (Head) Injury Data

7-7. Magnitude of the Traumatic Brain (Head) Injury Problem

Every year, roughly 2,000,000 Americans suffer a head injury and approximately 500,000 are hospitalized. Estimates of death due to head injury range from 40,000 to 100,000 annually, with about 80,000 individuals left with some form of permanent disability. The cost of head injuries for 1985 was estimated at \$37.8 billion* annually, of which \$4.5 billion was for direct medical expenditures.

* Max, W., Ed Mackenzie, and D.P. Rice. "Head Injuries: Costs and Consequences." *Journal of Head Trauma and Rehabilitation* 6:76, 1991.

In FY 1992, there were 4,208 cases of TBI treated in the military medical system with an additional 1,360 cases treated at private hospitals and paid for by CHAMPUS. The crude hospitalization rate was 137 per 100,000 cases for active duty men and 89 per 100,000 cases for active duty women. The following are characteristics of the injuries recorded in the head injury registry:

- 82% of the data represented men.
- 90% of the data represented closed head injuries.
- 62% of the data represented the fact that associated injuries were present.
- 15% of the data represented the fact that a craniotomy was performed.
- 37% of the data represented the fact that alcohol or drugs were present.

7-8. Incidence of Traumatic Brain (Head) Injuries

Figure 7-1 illustrates the rates of TBIs for military beneficiaries for FY 1992.

- The largest group of military personnel hospitalized for TBIs in FY 1992 consisted of active duty male beneficiaries, ages 18-24 (231 per 100,000 persons).
- The second largest group of military personnel hospitalized for TBIs in FY 1992 consisted of active duty male beneficiaries, ages 15-17 (204 per 100,000 persons).
- The smallest group of military personnel hospitalized for TBIs in FY 1992 consisted of female other beneficiaries, ages 35-44 (21 per 100,000 persons).

Rates of Traumatic Brain (Head) Injuries for Military Beneficiaries, FY 1992

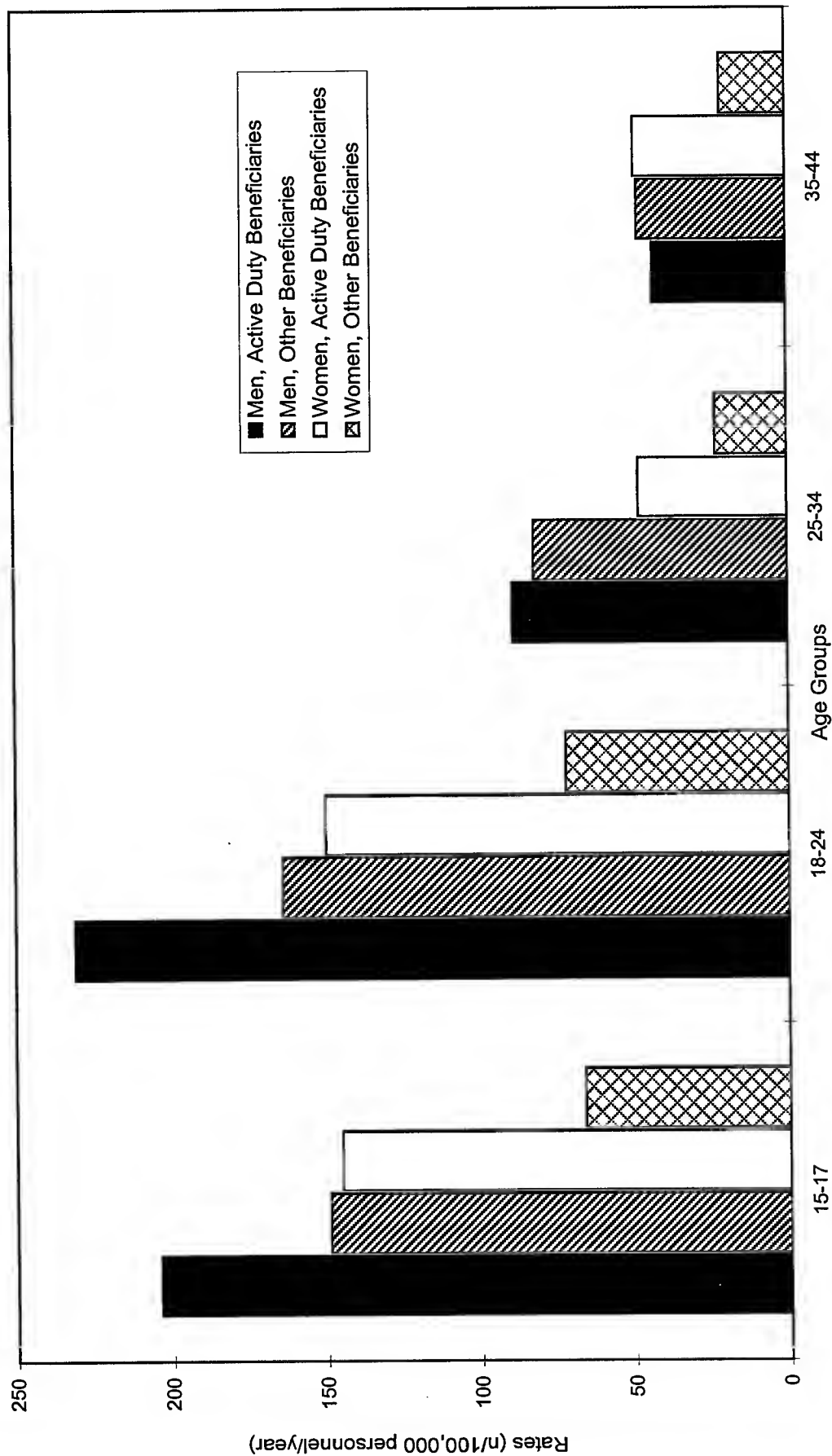


Figure 7-1

Source: Ommaya, Alexander K., et al. "Causation, Incidence, and Costs of Traumatic Brain Injury in the U.S. Military Medical System." *Journal of Trauma: Injury, Infection and Critical Care* 40(2):211-217, 1996.

7-9. Severity of Traumatic Brain (Head) Injuries

Figure 7-2 illustrates the FY 1992 distribution of the severity of TBIs on admission as determined by the Glasgow Coma Scale score, a scale used to classify the severity of a severe head injury (see Table 7-2). The distribution shows that over half of the TBIs are scored as mild:

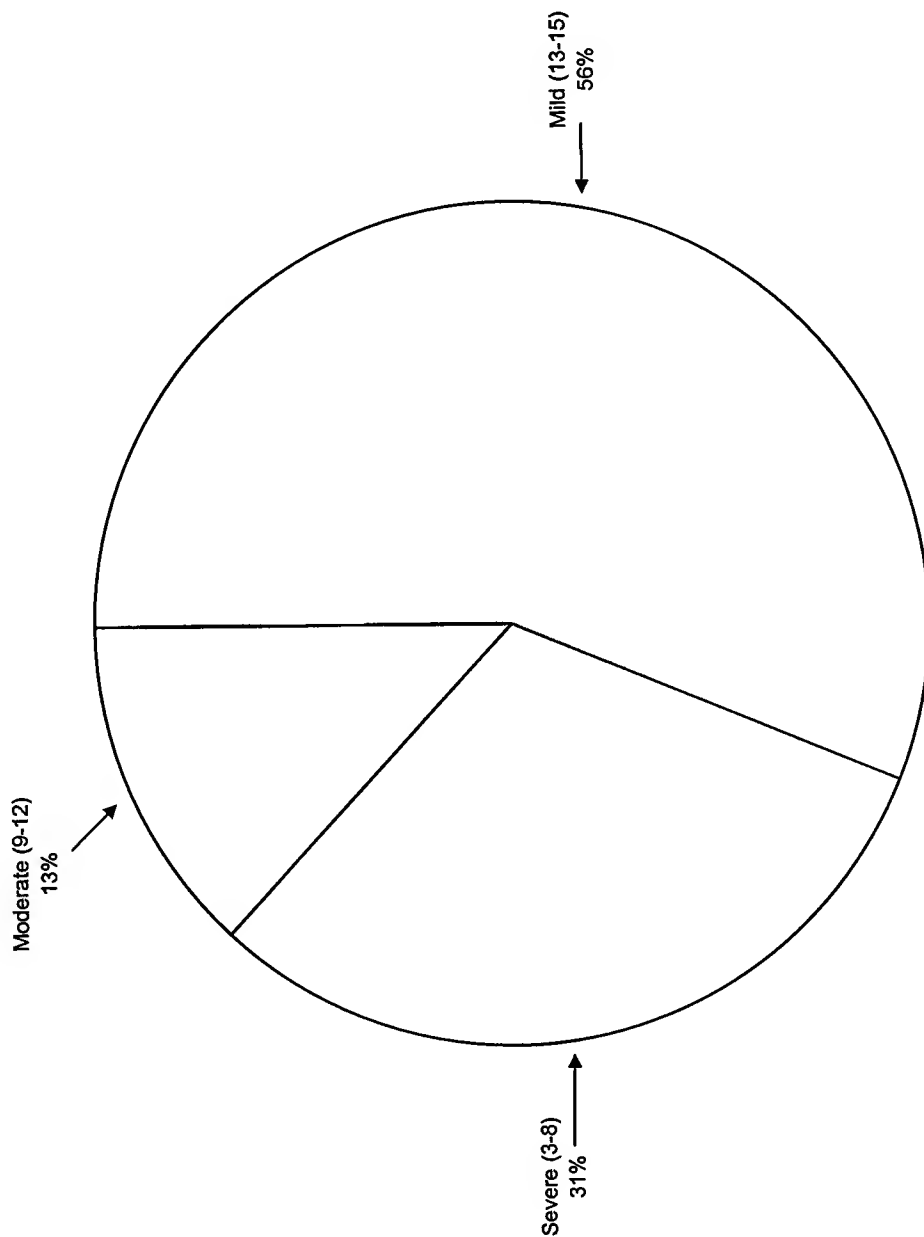
- Mild—56%.
- Severe—31%.
- Moderate—13%.

Table 7-2. Glasgow Coma Scale Scoring*

Measure		Score
Eye Opening:	Spontaneously	4
	To verbal command	3
	To painful stimuli	2
	None	1
Verbal Response:	Oriented and converses	5
	Disoriented and converses	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No audible sounds	1
Motor Response:	Follows verbal commands to painful stimuli	6
	Purposeful localization	5
	Withdraws from stimulus	4
	Flexor posturing	3
	Extensor posturing	2
	No response	1

* Total score equals eye opening + verbal response + motor response; scores range from 3 to 15.

Distribution (%) of Severity of Traumatic Brain (Head) Injuries on Admission as Determined by the Glasgow Coma Scale Score, FY 1992



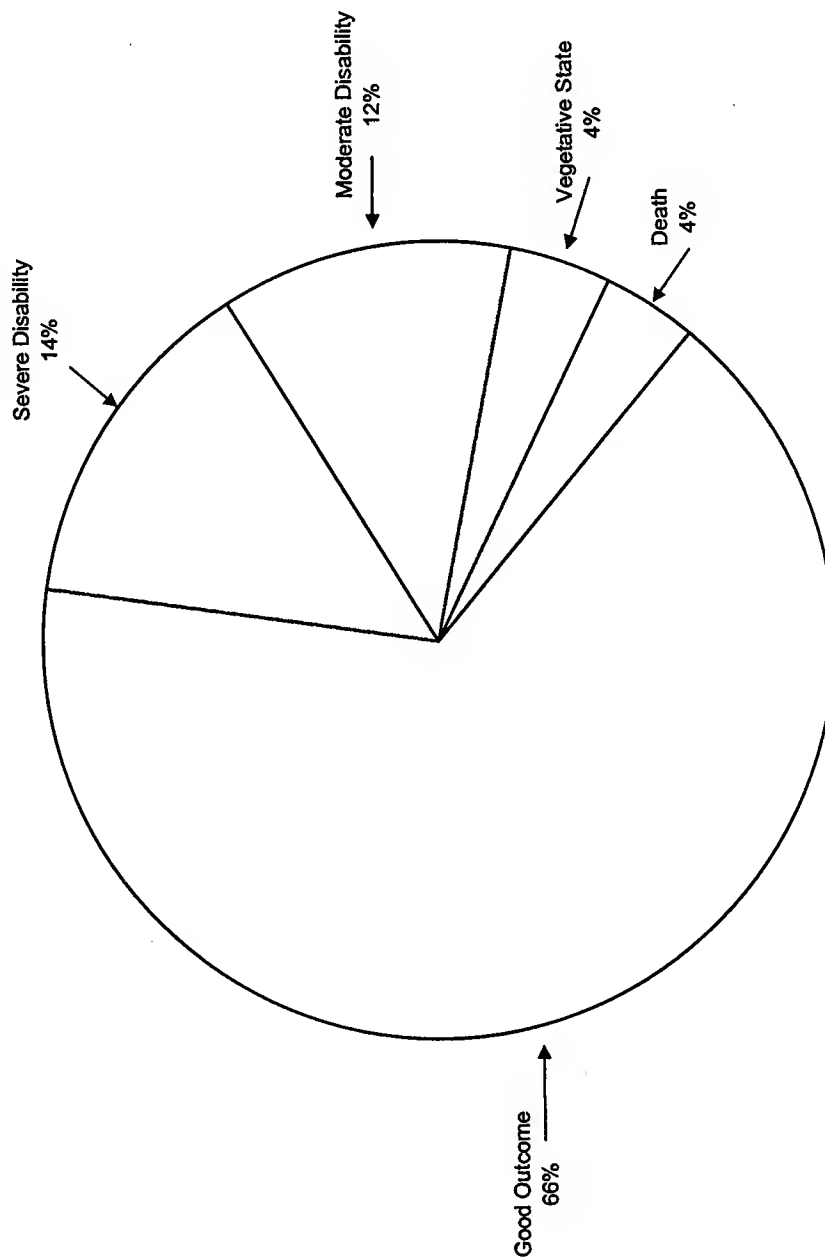
n = 600.
Glasgow Coma Scale Score appears in parentheses.
Source: Defense Veterans Head Injury Program, 1995.

Figure 7-2

Figure 7-3 illustrates the FY 1992 distribution of the status of TBI patients 7 days post-injury as determined by the Glasgow coma outcome score. The distribution shows that two thirds of the patients received a good outcome score:

- Good outcome—66%.
- Severe disability—14%.
- Moderate disability—12%.
- Vegetative state—4%.
- Death—4%.

Distribution (%) of Status of Traumatic Brain (Head) Injury Patients 7 Days Post-Injury as Determined by the Glasgow Coma Outcome Score, FY 1992



n = 600.

Source: Defense Veterans Head Injury Program, 1997.

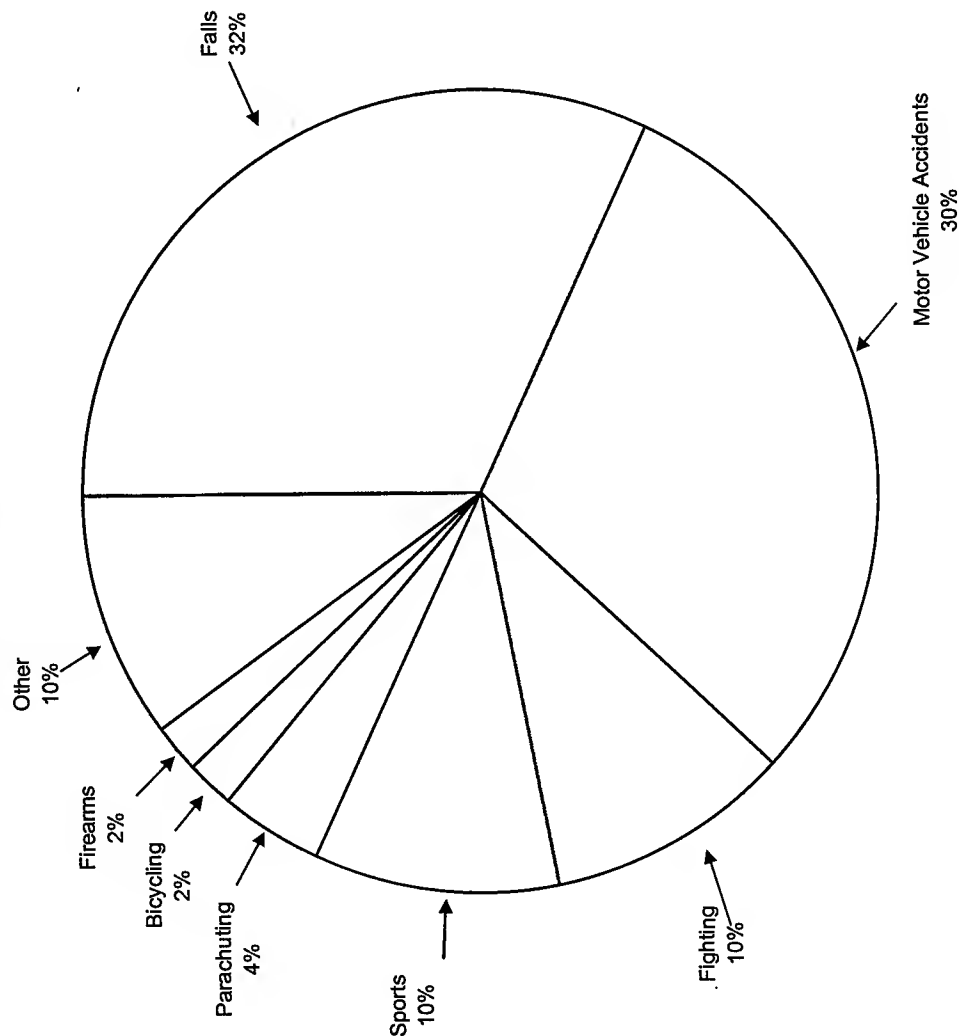
Figure 7-3

7-10. Causes of Traumatic Brain (Head) Injuries and Relative Risks of Important Causes

Figure 7-4 illustrates the distribution of causes of hospitalized TBIs in the U.S. military in FY 1992. The top five causes were:

- Falls—32%.
- Motor vehicle accidents—30%.
- Fighting—10%.
- Sports—10%.
- Parachuting—4%.

Distribution (%) of Causes of Hospitalized Traumatic Brain (Head) Injuries in the U.S. Military, FY 1992



n = 4,208.

Source: Ommaya, Alexander K., et al. "Causation, Incidence, and Costs of Traumatic Brain Injury in the U.S. Military Medical System." *Journal of Trauma: Injury, Infection and Critical Care* 40(2):211-217, 1996.

Figure 7-4

Table 7-3 displays a comparison of odds for TBIs in active duty and other beneficiary men and women for falls, motor vehicle accidents, fighting, and sports occurring in FY 1992.

- Among active duty men and women, there was no significant difference of TBI risk due to falls and motor vehicle accidents. As compared to active duty women, active duty men are 2.3 times more likely to sustain a TBI due to sports.
- A comparison of men and women and the other beneficiaries category shows that other male beneficiaries are at a greater risk of TBIs due to falls, motor vehicle accidents, and sports.
- Active duty men are 1.5 times more likely than other male beneficiaries to sustain a TBI due to a motor vehicle accident and approximately 4 times more likely to sustain a TBI due to fighting or sports.
- Risk of TBI due to falls, motor vehicle accidents, fighting, and sports is 4 to 12 times higher for active duty women as compared to other female beneficiaries.

Table 7-3. Comparison of Odds for Traumatic Brain (Head) Injuries in Active Duty and Other Beneficiary Men and Women, FY 1992*

Causes of TBIs	Active Duty Men: Women	Other Beneficiaries† Men: Women	Active Duty Men: Other†	Active Duty Women: Other†
Falls	NS	3.1	NS	4.4
Motor Vehicle Accidents	NS	3.8	1.5	6.4
Fighting	3.6	6.1	4.0	8.4
Sports	2.3	7.0	3.6	11.9

* Odds ratio adjusted for ages 15 to 44 years.

† Other beneficiaries = dependents of active duty personnel, retirees, or dependents of retirees.

NS = Not significant.

Sources: Ommaya, Alexander K. Briefing to DoD Injury Surveillance and Prevention Work Group, August 1995, and Ommaya, Alexander K., et al. "Causation, Incidence, and Costs of Traumatic Brain Injury in the U.S. Military Medical System." *Journal of Trauma: Injury, Infection and Critical Care* 40(2):211-217, 1996.

7-11. Costs of Traumatic Brain (Head) Injuries

The direct costs of hospitalizations for TBIs in the U.S. military medical system in FY 1992 totaled \$42 million. Of that amount, \$20.6 million (4,208 admissions) went to military hospital costs. The CHAMPUS allowed amount for private hospitals was \$21.4 million (1,360 admissions).

Table 7-4 displays TBI hospitalization median cost and length of stay figures for FY 1992.

Table 7-4. Traumatic Brain (Head) Injury Hospitalization for Loss of Consciousness (LOC) Median Cost and Length of Stay* for Non-Active Duty Admissions, FY 1992

LOC	Median Cost		Average Length of Stay (Days)	
	Private Hospitals	Military Hospitals	Private Hospitals	Military Hospitals
> 1 hr (SE)	\$10,802	\$3,912	27.0 (5.1)	16.7 (2.0)
< 1 hr (SE)	\$3,902	\$1,092	5.0 (0.4)	4.2 (0.3)
None (SE)	\$2,521	\$842	6.2 (2.2)	2.8 (0.2)
Unspecified (SE)	\$2,874	\$1,378	7.5 (0.8)	5.9 (0.3)
Total (SE)	\$4,438	\$1,378	8.1 (0.8)	5.1 (0.2)

* Private facilities exclude skilled nursing, psychiatric, and rehabilitation facilities. Private costs are CHAMPUS allowed costs. Military costs are based on average cost per occupied bed day plus associated private facility costs.

SE = standard error (data shown in parentheses).

Sources: Ommaya, Alexander K. Briefing to DoD Injury Surveillance and Prevention Work Group, August 1995, and Ommaya, Alexander K., et al. "Causation, Incidence, and Costs of Traumatic Brain Injury in the U.S. Military Medical System." *Journal of Trauma: Injury, Infection and Critical Care* 40(2):211-217, 1996.

Section III. Suggested Uses of the Head Injury Registry Data

The primary, and most obvious, use of the DVHIP data is to monitor head injury rates. However, the detailed data collected on each case in the Head Injury Registry can also provide information to support necessary programs and interventions which would help prevent head injuries. For example:

- Data that defines the severity and specific symptoms from which the patient is suffering could be used to identify cases that may benefit from behavioral and/or medical intervention.
- Data on the cause of injury could provide evidence for the need to:
 - Test and improve safety systems (helmets, restraint devices, etc.).
 - Enforce alcohol, seat belt, and helmet use laws on military property.
 - Provide training in conflict resolution to prevent fist fights.
 - Work with coaches and trainers to recognize TBI symptoms during sporting events and practice.

CHAPTER 8

TOTAL ARMY INJURY AND HEALTH OUTCOMES DATABASE: A MODEL COMPREHENSIVE RESEARCH DATABASE

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Section I. Description of the Total Army Injury and Health Outcomes Database

8-1. Introduction

The impact of injuries on the mission, readiness, and budget of the U.S. Armed Forces is dramatic. To uncover the complete spectrum of injury morbidity and mortality among service members, the U.S. Army Research Institute of Environmental Medicine (USARIEM) developed the Total Army Injury and Health Outcomes Database (TAIHOD). The creation of the TAIHOD was the initial action of USARIEM's protocol OMD95001-AP-H001, "The Impact of Injuries on the Health and Readiness of Women in the Army from 1980-1994." This protocol, approved in December 1994, was designed to investigate injuries among women in the Army over a 15-year period by combining existing personnel and medical outcomes data from various Army and DoD sources into a single relational database.

The TAIHOD is a versatile system that joins multiple personnel and health data sets from six separate DoD agencies. Each agency, at the request of USARIEM, created a data set that included only active duty Army soldiers. These data sets were then transferred to a single high-capacity computer server at USARIEM.

8-2. Mission

The U.S. Army Medical Research and Materiel Command (USAMRMC) manages and executes a worldwide research and development (R&D) mission aimed at military medical problems of importance to national defense. The medical R&D programs within the command provide data and materiel necessary to protect, maintain, or restore the health of the individual service member. At USARIEM, a subordinate command of USAMRMC, the Military Performance Division conducts epidemiological studies of injuries among Army personnel.

8-3. Purpose of the TAIHOD

The purpose of this relational database is to:

- Join multiple personnel, administrative, and health data sets for epidemiological research.
- Use the soldiers' encrypted social security numbers as a key to link three general categories of data:
 - Demographics (the parameters for the denominator).
 - Outcomes (hospitalizations, lost time injuries, permanent disabilities, and fatalities).
 - Self-reported health habits and risk-taking behavior from surveys.

In turn, USARIEM's research epidemiologists use TAIHOD to directly link Army personnel records and self-reported health habits to specific health outcomes, and to trace the interrelationship of these outcomes over time. Using carefully structured data queries, the database supports epidemiological health research in injury control, occupational hazards, health promotion, and disease prevention.

8-4. Authority

By Section 6, General Order No. 33, Department of the Army, 20 September 1961, and General Order No. 40, Office of The Surgeon General, 1 December 1961, USARIEM was established a Class II medical activity.

8-5. Contents of Database

Each individual data component in the TAIHOD offers an excellent source of data for study. In addition, the ability to link all of these data components at the level of the individual soldier provides a truly extraordinary opportunity for research. The TAIHOD represents a versatile system that thus far integrates six master databases:

- Personnel data archived by the Defense Manpower Data Center (DMDC), Seaside, California.
- The Individual Patient Data System (IPDS) maintained by the Directorate of Patient Administration System and Biostatistics Activity (PASBA), Fort Sam Houston, Texas.
- The Army Safety Management Information System (ASMIS) maintained by the U.S. Army Safety Center, Fort Rucker, Alabama.
- Army disability data maintained by the Physical Disability Case Processing System, WRAMC, Washington, D.C.
- The Army Casualty Information Processing System (ACIPS) maintained by the Army Casualty Office, Alexandria, Virginia, as well as the complete database of the WHS, DIOR, Washington, D.C.
- The Health Risk Appraisal (HRA) Data Set maintained by the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), Aberdeen Proving Ground, Maryland.

Table 8-1 presents a summary of the data collected within each of the six current master databases, and illustrates how the atlas demonstrates the use of these administrative databases for both injury surveillance and epidemiologic study. The TAIHOD system, born of the efforts of the DoD Injury Surveillance and Prevention Work Group, is capable of leveraging these data sources well beyond their primary purpose. The ability to link records from the respective databases at the level of the soldier creates a truly exponential benefit for epidemiological inquiry.

Table 8-1. The TAIHOD's Six Master Databases: A Summary of Data Collection

Databases	Types of Data	Records				Unique Individuals*			Summary
		Total No.	% Women	% Men		Total No.	% Women	% Men	
DMDC, CY 1980-1998	Personnel <ul style="list-style-type: none"> • Demographic Variables • Hazardous Duty Pay • Service Dates • Reason for Discharge • Gulf War Deployments 	27,497,400	11.1	88.9		2,789,800	12.5	87.5	The TAIHOD currently integrates personnel records on all current and former active duty Army soldiers (CY 1980-1998). <ul style="list-style-type: none"> • This cohort now represents over 2.7 million people; about 12% are women and over 7% are minority women. • The addition of health habit surveys adds a behavioral component to this process, providing another powerful dimension to the research capability of the TAIHOD.
IPDS, CY 1980-1998 <i>Note: Chapter 5 of the Atlas used data from the IPDS.</i>	Hospitalization <ul style="list-style-type: none"> • Diagnoses • Injury Type/Cause • Bed Days • Non-Army Hospitalizations 	1,745,300	24.9	75.1		944,800	19.5	80.5	
ASMIS, CY 1980-1998 <i>Note: Chapter 3 of the Atlas used data from the ASMIS.</i>	Lost-Time Injury <ul style="list-style-type: none"> • Unintentional Aviation Incidents • Unintentional Ground Incidents • Event Specific Information 	5,000 127,400	1.6 6.7	98.4 93.3		1,600 120,400	1.7 6.8	98.3 93.2	
Army Disability, CY 1980-1997 <i>Note: Chapter 4 of the Atlas used data from the Army disability database.</i>	Disability <ul style="list-style-type: none"> • Percentage of Disability • Functional Disability (VASRD) Codes • Line-of-Duty Relationship • Case Outcomes 	137,000	13.4	86.6		105,000	13.4	86.6	The ability to link comprehensive demographic and occupational data to specific health outcomes, at the individual level, allows evaluation of injury and illness risk based on individual soldier attributes, habits, and exposures.
ACIPS, CY 1980-1997 <i>Note: Chapter 2 of the Atlas used data from the ACIPS and WCS.</i>	Casualty <ul style="list-style-type: none"> • Event Specific Information • Cause of Death 	10,900	5.6	94.4		—	—	—	

Table 8-1.—Continued

Databases	Types of Data	Records			Unique Individuals*			Summary
		Total No.	% Women	% Men	Total No.	% Women	% Men	
HRA, CY 1989-1997	Health Risk <ul style="list-style-type: none"> • Self-Reported Health Habits • Physiological Measurements 	514,800	13.6	86.4	403,800	13.7	86.3	

* A person who is now or has been on active duty. A unique individual may have any number of records.

8-6. The TAIHOD's Master Databases

The Defense Manpower Data Center Personnel Data.

The core of the TAIHOD is the DMDC data set, which includes over 27 million soldier records and serves primarily to isolate subpopulations for study and provide demographic control variables. The DMDC loss files also contain service discharge codes—important outcome variables.

Types of personnel data include:

- **Demographic.** Demographic variables (such as age, gender, race, ethnic group, rank, unit, zip code, marital status, number of dependents, home of record, military occupational specialty (MOS), education level, total months in Federal service, aptitude test scores, induction height and weight, and barracks or other housing status) are available on most Army service members. This information may be linked with any of the other five current database components. To maintain confidentiality, the social security numbers are scrambled and all names are eliminated from the TAIHOD database.
- **Pay.** Separate pay files for hazardous duty that address parachuting, flying, diving, combat, hostile fire, and environmental stress allow identification and analysis of these high-risk groups.
- **Loss.** Loss files were obtained for the entire interval, allowing precise determination of each member's date of arrival and departure from the Army. The loss files include codes for the reason for discharge (e.g., retirement, misconduct, end of tour, drug or alcohol, pregnancy, etc.).
- **Gulf War.** Active duty deployment status as well as Army Reserve and National Guard activation/deployment during the Gulf War are contained in the database, as well as data on other Army Reserve and National Guard soldiers on active duty.

Figure 8-1 illustrates types of personnel data, number of records, and number of unique individuals associated with the DMDC data for CY 1980-1998.

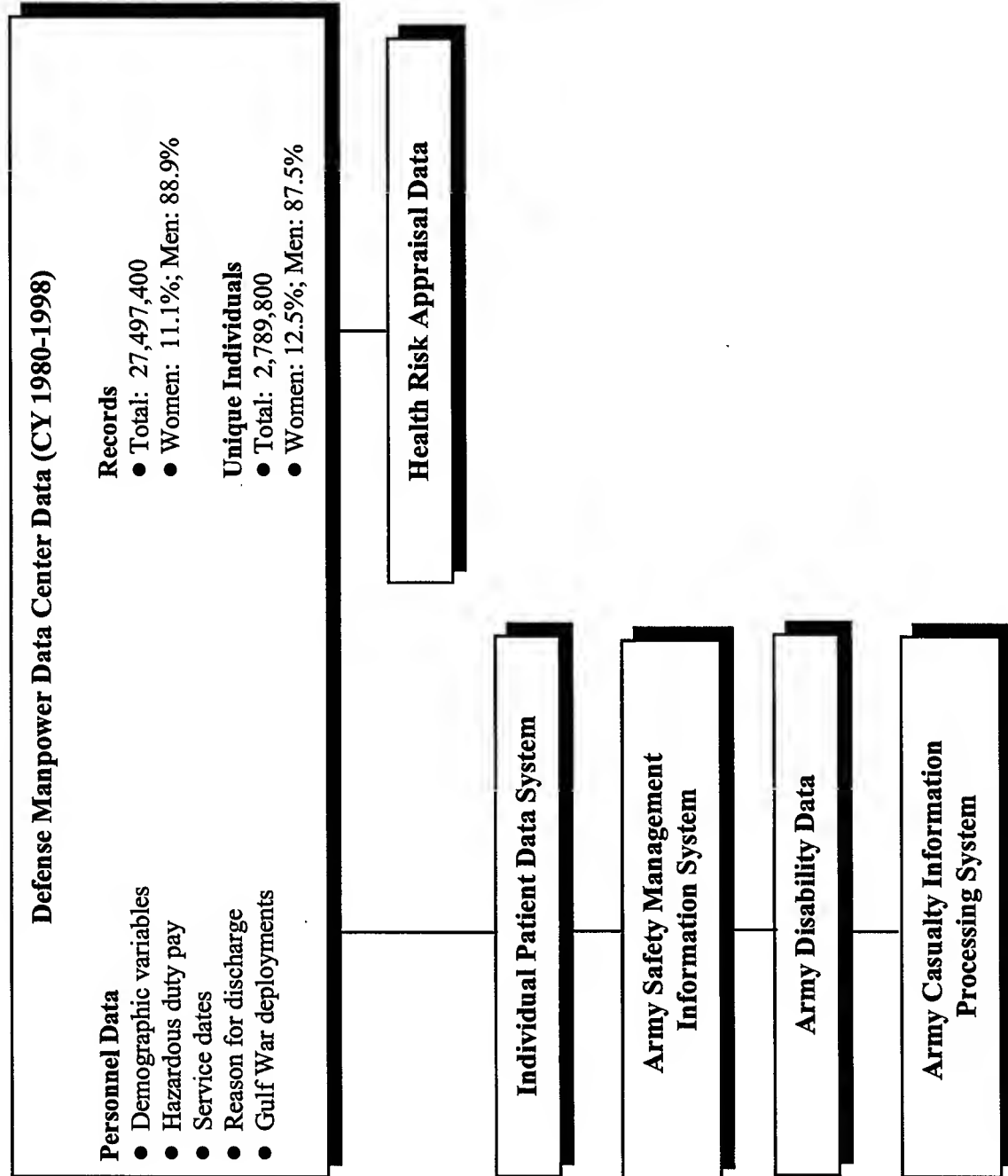


Figure 8-1. Defense Manpower Data Center Personnel Data, CY 1980-1998

The Individual Patient Data System.

The IPDS initially provided approximately 1.7 million hospitalization records covering all Army personnel admitted to Army medical treatment facilities and civilian hospitals from CY 1980-1994. Although the IPDS was not specifically implemented for the purpose of injury surveillance or prevention, its comprehensive, highly standardized record system makes it an especially useful tool for injury and health research. The presence of an extensive cause-of-injury coding system, and the ability to track readmission and calculate lost-duty time due to hospitalization gives this data exceptional power. The IPDS data include:

- **Diagnoses.** Using standard methods, specific discharge diagnoses were abstracted from the medical record and then coded according to standard ICD-9 coding (see Appendix A, Table A-3). Up to eight diagnoses and procedures are recorded for each discharge.
- **Injury Type/Cause.** The Army does not use the ICD system for coding cause of injury. Instead, the STANAG 2050 coding system is used (see Appendix A, Table A-1). The cause-of-injury codes are available on virtually 100 percent of all soldiers hospitalized for injury. These three-part codes classify not only the activity at the time of injury, but also intent and location. The level of coding (100 percent) inherent in this system is unmatched by any other U.S. civilian hospital system, even among states that have mandates for cause-of-injury coding.
- **Bed Days.** The IPDS captures the number of days on the hospital rolls (i.e., in a hospital bed or on convalescent leave).
- **Non-Army Hospitalizations.** Active duty Army soldiers hospitalized in civilian hospitals are also included (absent sick cases). Records of Army personnel hospitalized in Navy and Air Force facilities are obtained from another source. Army soldiers hospitalized in civilian hospitals comprise approximately 3% of the total hospitalizations.

Figure 8-2 illustrates types of hospitalization data, total number of records, and number of unique individuals associated with the IPDS for CY 1980-1998.

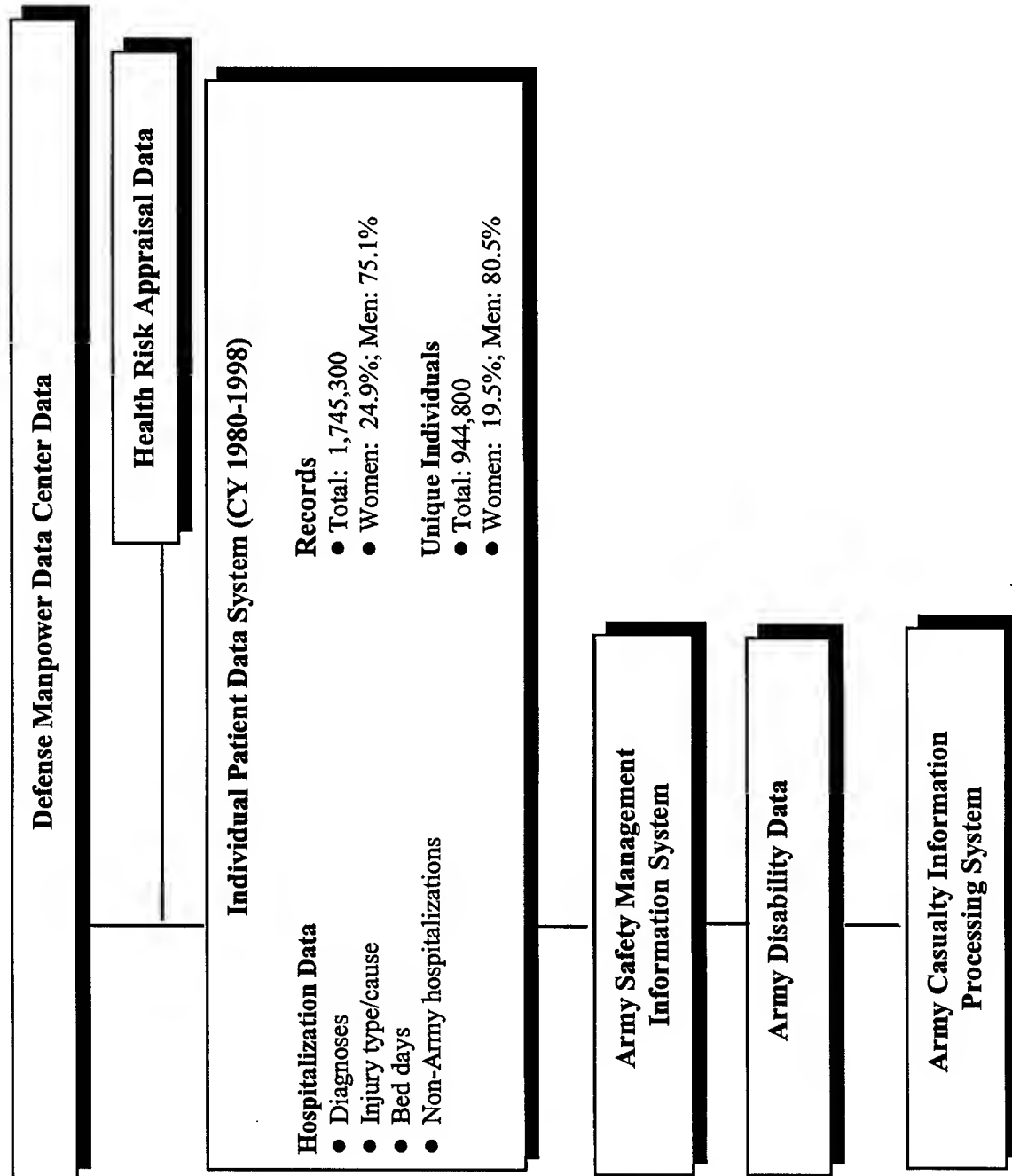


Figure 8-2. Individual Patient Data System, CY 1980-1998

The Army Safety Management Information System.

The ASMIS contains cause and activity data on almost 133,000 ground and aviation accidents describing equipment, weapons systems, and vehicles involved in crashes. Additional data on many hospital and fatality cases are also available. This database also contains cases not serious enough to require hospitalization and, therefore, provides a crucial, detail rich window to injuries not requiring hospitalization.

Types of lost-time injury data include:

- **Unintentional Aviation Incidents.** The variables include aircraft type, body part injured, injury type (fracture, sprain, etc.), date of injury, place of occurrence, severity of injury, days of limited duty, and an estimate of injury and incident cost.
- **Unintentional Ground Incidents.** The variables include activity at time of injury, body part injured, injury type (fracture, sprain, etc.), date of injury, place of occurrence, severity of injury, days of limited duty, and an estimate of injury and incident cost.
- **Event Specific Information.** The variables in this category describe other characteristics of the incident including personal protective equipment use, drug use, environmental conditions, and up to 500 words of free text describing the event.

Figure 8-3 illustrates types of lost-time injury data, total number of records, and number of unique individuals associated with the ASMIS for CY 1980-1998.

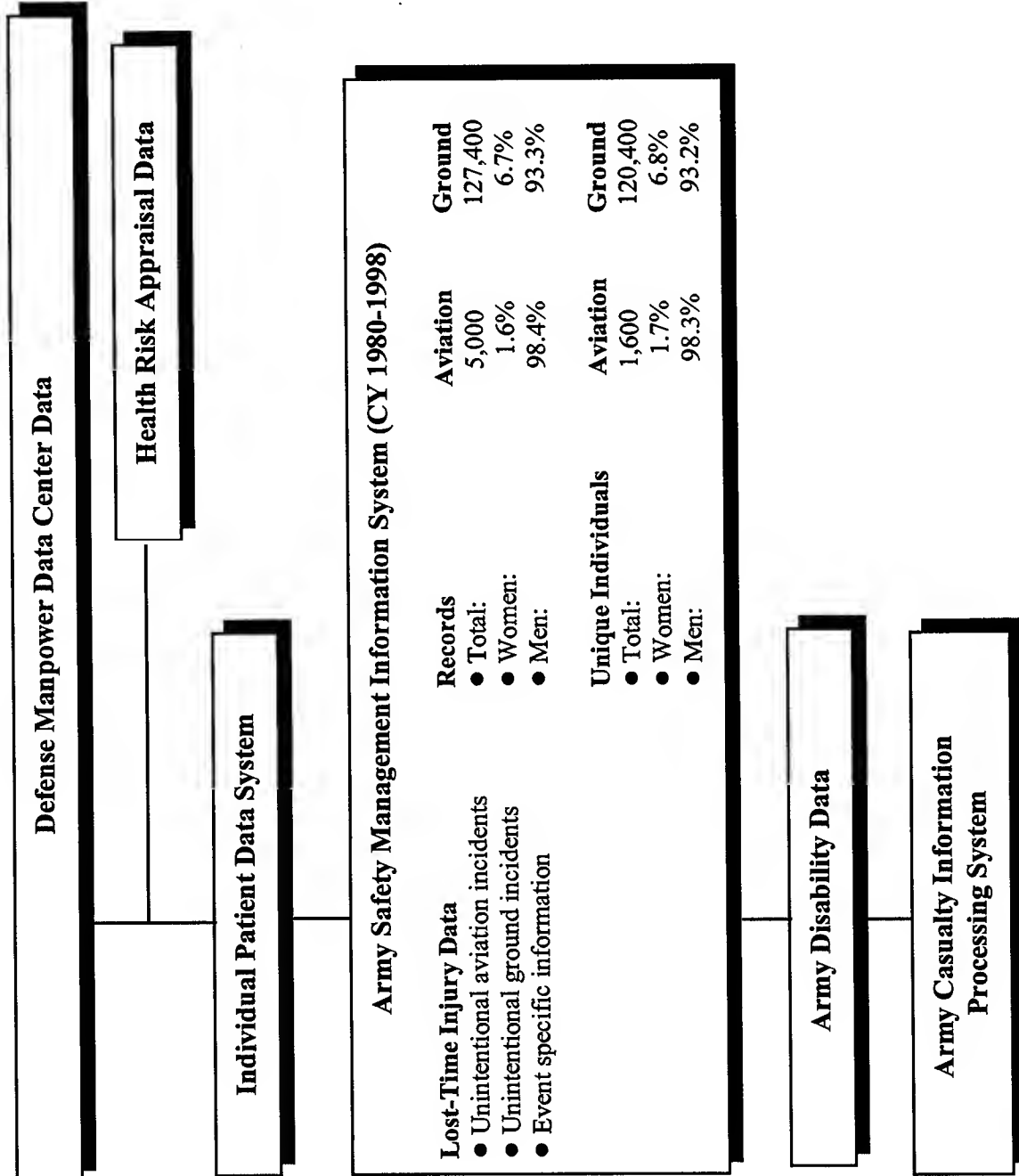


Figure 8-3. Army Safety Management Information System, CY 1980-1998

The Army Disability Data Set.

The Army Disability Data Set provides records on 105,000 disability board cases with functional disability ratings according to the VASRD (see Appendix A, Table A-2). When linked to the other TAIHOD components, hospital ICD-9 codes as well as career statistics can be evaluated. The ability to link hospital records to disability cases is yet another unique strength of the TAIHOD.

Types of disability data include case-specific information such as:

- **Percentage of Disability.** All disability cases (unless found fit) are assigned a percentage of disability, which is related to ability to perform duties (0-100% disabled) and is a significant factor in the determination of financial compensation, if any.
- **Functional Disability (VASRD) Codes.** Indicates VASRD code assigned to the case.
- **Line-of-Duty Relationship.** Indicates whether disability was deemed to be service connected or not.
- **Case Outcomes.** Indicates type of discharge or whether individual was returned to duty.

Figure 8-4 illustrates types of disability data, total number of records, and number of unique individuals associated with the disability database for CY 1980-1997.

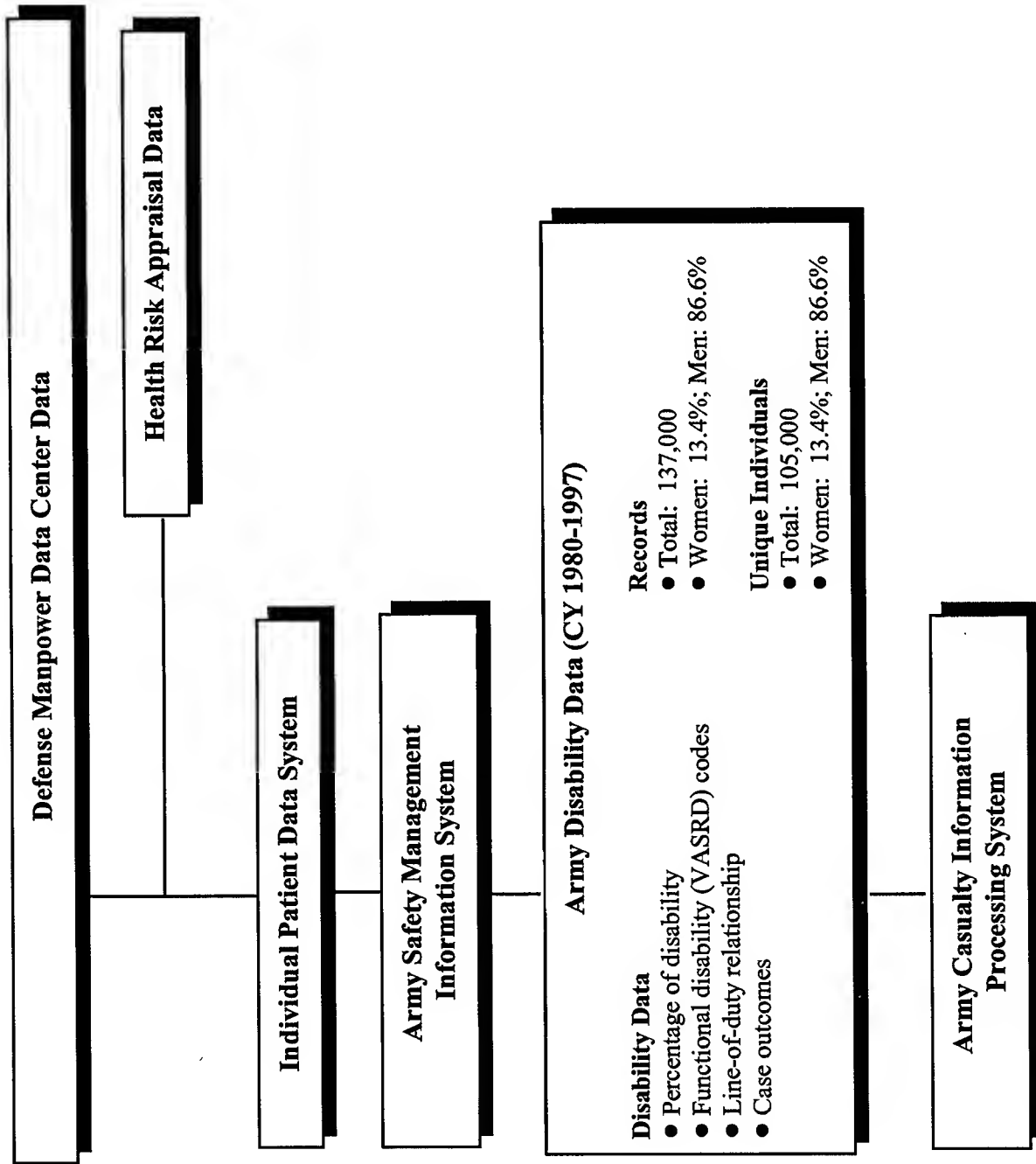


Figure 8-4. Army Disability Data, CY 1980-1997

Army Casualty Information Processing System.

The ACIPS provides data on the cause, time, and place of death on almost 11,000 Army active duty soldiers. The entire DIOR (WCS) database is also contained in the TAIHOD. By linking casualty data to safety and hospitalization data, researchers can conduct very elaborate fatality studies. Researchers can also evaluate many risk factors for injury fatalities by accessing data on self-reported health habits and risk-taking behavior.

Types of casualty data include:

- **Event-Specific Information.** Variables include the time and place the event occurred, general casualty code (accident, illness, etc.), and specific circumstances codes.
- **Manner of Death.** Casualties are categorized as an accident, hostile action, homicide, illness, missing, determination pending, suicide, terrorist activity, or unknown. Specific cause of death is not given.

Figure 8-5 illustrates the types of casualty data, total number of records, and number of unique individuals associated with ACIPS for CY 1980-1997.

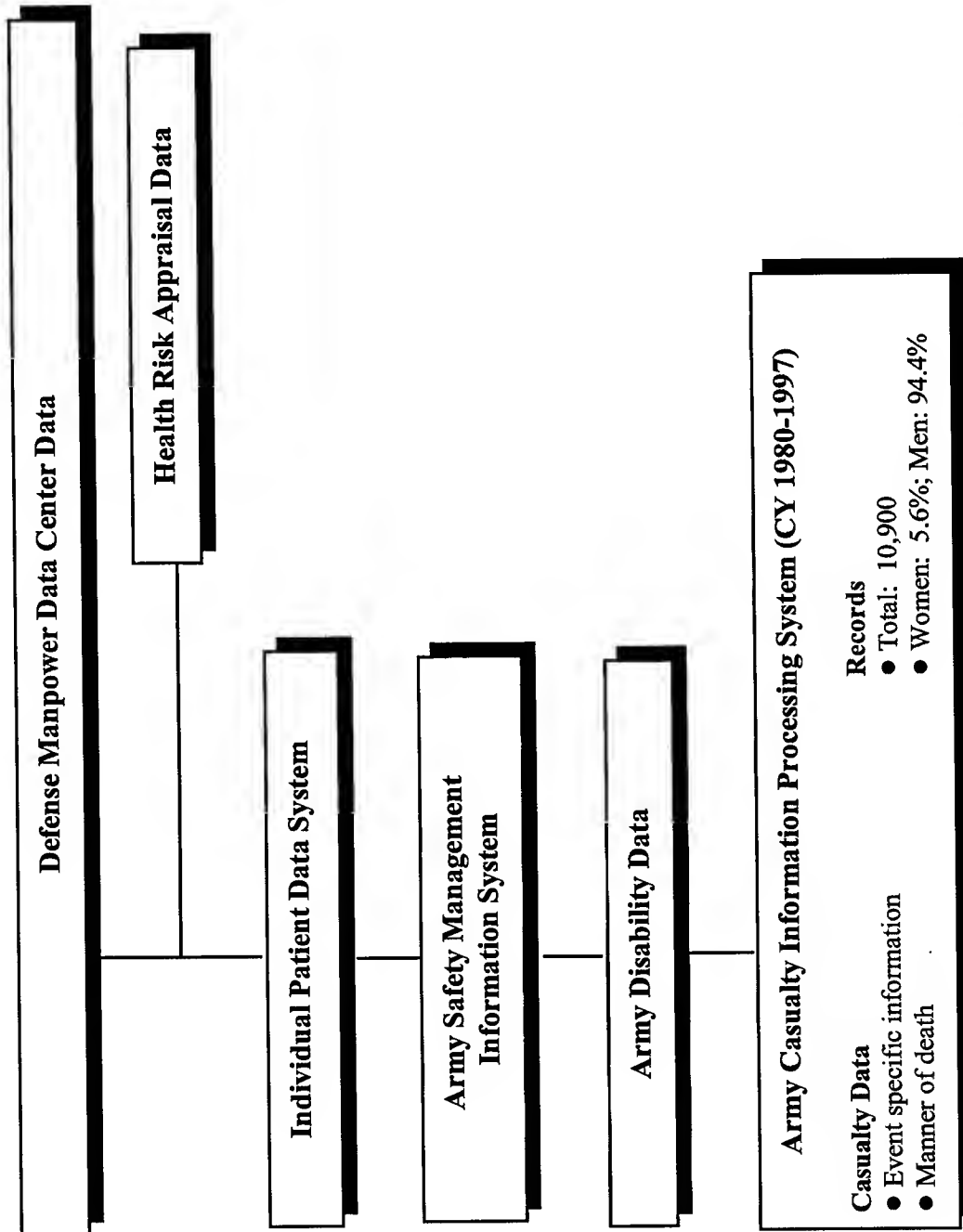


Figure 8-5. Army Casualty Information Processing System, CY 1980-1997

The Health Risk Appraisal Data.

The HRA data set includes well over 500,000 surveys administered by the Army. The survey is given in a variety of settings including unit inprocessing, periodic physical exams, unit physical fitness testing, occupational health screenings, and by command direction such as predeployment. (A copy of the survey is included as Appendix H in the USARIEM Report No. TN97-2, TAIHOD: Description and Capabilities, 21 Feb 97.)

More than 500,000 of these surveys are linked to the Army DMDC personnel files. The HRA data include self-reported health habits such as diet, exercise, tobacco and alcohol use, stress levels, job satisfaction, and risk-taking behavior. By analyzing this information against other TAIHOD files for the same Army subpopulations, researchers can determine the relationship between health habits and the incidence of injury and illness. The HRA data also include physiologic measures of health which can be assessed for their relationship with the occurrence of injury or illness.

Types of health risk data include:

- **Self-reported Health Habits.** Some representative variables include dietary habits, smoking habits, weight, physical activity, and alcohol use.
- **Physiological Measurements.** Certain HRA screenings include an EKG, blood pressure, and/or serum lipid and blood sugar determinations.

Figure 8-6 illustrates types of health risk data, total number of records, and number of unique individuals associated with HRA for CY 1989-1997.

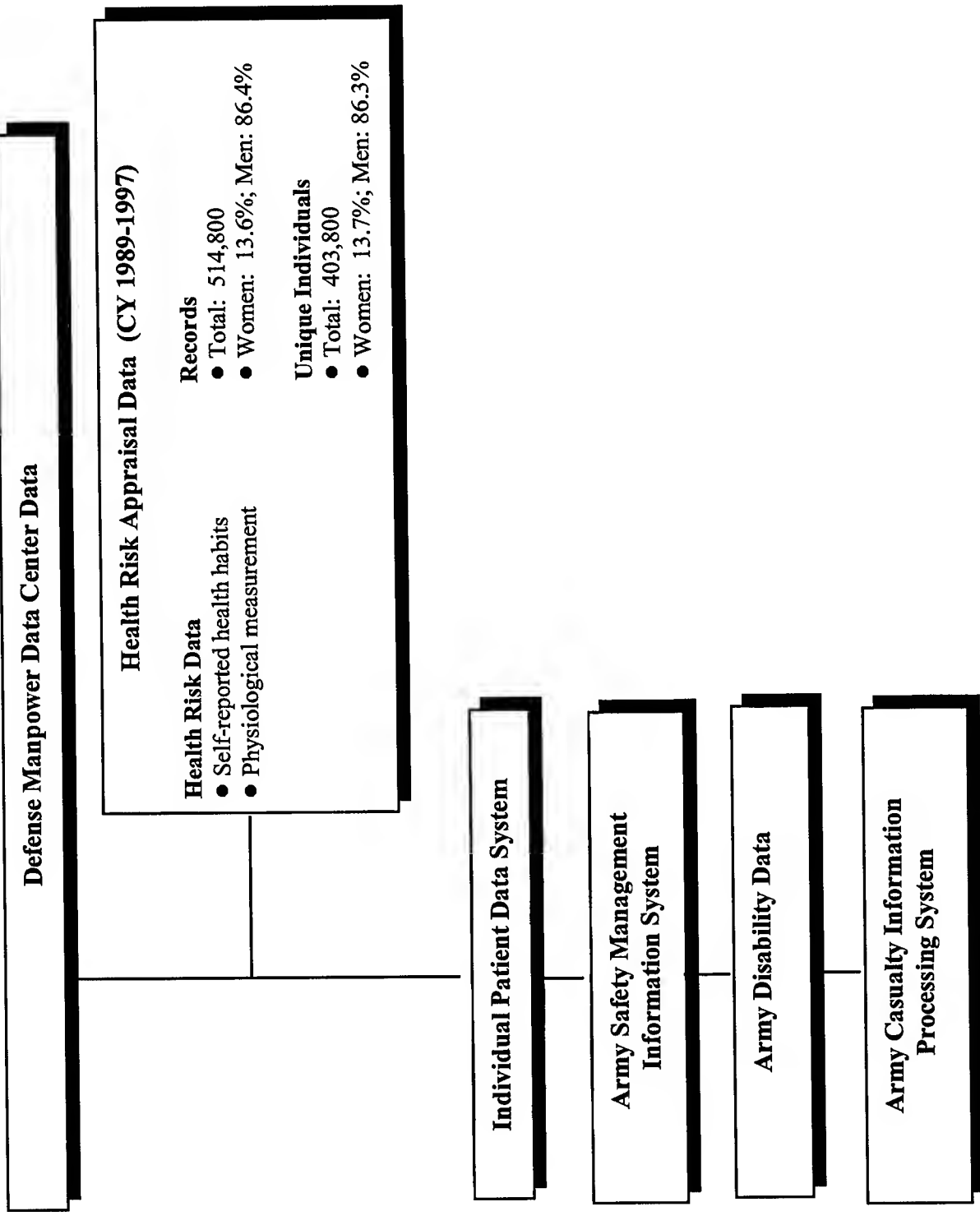


Figure 8-6. Health Risk Appraisal, CY 1989-1997

Section II. Application of the Total Army Injury and Health Outcomes Database

8-7. Structured Data Inquiries

Carefully structured data queries using the TAIHOD support epidemiological health research in injury control, occupational hazards, health promotion, and disease prevention. By linking information from various TAIHOD databases, researchers can:

- Investigate problems.
- Recommend solutions.
- Help management resolve important health issues.

The following actual inquiries illustrate the usefulness of the TAIHOD in various types of epidemiological health research.

NOTE: The following four examples link personnel and/or HRA data to hospitalization and death files. Similar analyses can also be done using disability and/or lost-time from work injury data as the outcomes of interest.

Perhaps the most powerful analyses of all will examine outcomes from particular Army subpopulations using multiple TAIHOD database components. An example of this might be the potential value added in the study of fatalities using not just the casualty files, but also the—

- personnel files (loss files);
- hospital files (all inpatient and a majority of outpatient deaths are recorded);
- safety databases (unintentional injury deaths are recorded with substantial free text); and
- HRA survey (adding risk-taking behavior).

Since each data set contains somewhat different information on the same individuals and events, more comprehensive study is possible than with any individual sources of data alone.

Inquiry 1: Hospitalization Risk by Army Military Occupational Specialty.*

- **Background.** Women and men in the Army represent a very heterogeneous population engaged in diverse occupational activities, each with unique hazards and physical demands. While some jobs are still closed to women, most are now available to both genders. Many factors influence risk of hospitalization. One unique attribute of the DoD hospitalization databases is that they include all hospitalization records whether the problem is duty related or not. An additional strength of the TAIHOD database is not only its ability to study groups of soldiers based on their major occupational category, but also to compare women and men *within* occupational groups based upon their individual characteristics and health habits.
- **How TAIHOD Was Used.** To evaluate injury and illness hospitalization risk for women and men populating the largest occupational specialties, the following preliminary analysis was conducted:
 - All soldiers on active duty between CY 1990 and 1994 were selected from the DMDC database. A subset comprised of the 25 largest MOSs was then selected for study. Each individual's length of service during the interval was calculated to determine the denominator (person years contributed). Occupational subgroups were created using the first three digits of the MOS.
 - Hospitalizations for all injury and musculoskeletal conditions from the IPDS were linked to the population DMDC data to create the numerator. Because of the relative importance of pregnancy-related hospitalizations for women, these hospitalization rates were included for comparison.

* Amoroso, P.J., M.M. Yore, G.S. Smith, and M. Lopez. Analysis of Military Occupational Specialties and Hospitalizations. Part I. The 25 Largest Army Enlisted Occupations. USARIEM Technical Report T98-7, Natick, MA, November 1997.

- **Results.** Excerpts of the key results are presented in **Table 8-2**.
 - The male occupation with the highest hospitalization rates for both injury and musculoskeletal conditions was infantry (11B).
 - For women, injury hospitalizations were highest among medical specialists (91A), while hospitalizations for musculoskeletal conditions were highest among light-wheeled mechanics (63B).
 - There was substantial variation between occupational groups and between genders, undoubtedly reflecting both risk exposure differences and the varied demographic composition of these occupational groups.

Table 8-2. Hospitalization Rates for the Largest 25 Military Occupational Specialties, CY 1990-1994

Duty MOS Codes and Categories	Sex	Rates of Hospitalization* by Primary Diagnosis/ICD-9 Codes			Other Hospital	Total Hospitalization Rate*
		800-904.99, 910-957.99, 960-995.99 (Injury/Poisoning)	710-739 (Musculoskeletal)	630-676.9 (Pregnancy)		
11B, Infantry	Male	260	248	—	838	1346
11C, Infantry	Male	221	194	—	720	1135
11H, Infantry	Male	221	234	—	729	1184
11M, Infantry	Male	224	173	—	725	1122
12B, Combat Engineering	Male	230	206	—	874	1310
13B, Field Artillery	Male	214	191	—	818	1223
13F, Field Artillery	Male	212	214	—	767	1192
19D, Armor	Male	227	184	—	738	1149
19K, Armor	Male	221	187	—	748	1156
31C, Communications--Electronic Maintenance	Male	178	187	—	823	1188
	Female	138	248	1379	1751	3515
	Overall	174	194	—	925	1444
31K, Communications--Electronic Operations	Male	168	155	—	853	1176
	Female	122	308	1655	1793	3878
	Overall	165	164	—	904	1322
52D, Power Generation Equipment Repairer	Male	168	195	—	780	1142
	Female	139	293	1114	1642	3189
	Overall	166	200	—	820	1237
54B, Chemical	Male	176	228	—	882	1285
	Female	146	308	1186	1807	3447
	Overall	173	235	—	964	1477
63B, Mechanical Maintenance	Male	155	221	—	823	1198
	Female	134	310	1412	1881	3737
	Overall	153	227	—	902	1388

Table 8-2.—Continued

Duty MOS Codes and Categories	Sex	Rates of Hospitalization* by Primary Diagnosis/ICD-9 Codes			Other Hospital	Total Hospitalization Rate*
		800-904.99, 910-957.99, 960-995.99 (Injury/Poisoning)	710-739 (Musculoskeletal)	630-676.9 (Pregnancy)		
63H, Mechanical Maintenance	Male	137	236	—	736	1109
	Female	63	213	1485	2022	3783
	Overall	133	235	—	806	1254
71L, Administration	Male	117	205	—	862	1184
	Female	79	196	1244	1503	
	Overall	100	201	—	1150	
75B, Personnel Administration Specialist	Male	125	195	—	746	1066
	Female	86	190	1316	1479	3071
	Overall	115	194	—	929	1567
76C, Supply	Male	147	182	—	872	1200
	Female	120	206	1732	1653	3711
	Overall	141	187	—	1054	1784
76Y, Supply	Male	144	194	—	845	1182
	Female	92	207	1423	1690	3411
	Overall	132	197	—	1027	1662
77F, Petroleum Supply Specialist	Male	173	199	—	926	1298
	Female	179	222	1487	1875	3763
	Overall	175	203	—	1109	1773
88M, Motor Transport Operator	Male	190	217	—	886	1293
	Female	143	241	1475	1813	3671
	Overall	183	220	—	1017	162.9
91A, Medical	Male	238	207	—	1235	1679
	Female	206	300	1531	2465	4502
	Overall	231	227	—	1499	2287

Table 8-2—Continued

Duty MOS Codes and Categories	Sex	Rates of Hospitalization* by Primary Diagnosis/ICD-9 Codes			Other Hospital	Total Hospitalization Rate*
		800-904.99, 910-957.99, 960-995.99 (Injury/Poisoning)	710-739 (Musculoskeletal)	630-676.9 (Pregnancy)		
91B, Medical	Male	168	248	—	1079	1495
	Female	124	281	1356	2082	3843
	Overall	160	254	—	1264	1928
94B, Food Service	Male	158	192	—	1035	1384
	Female	142	192	1557	1810	3701
	Overall	154	192	—	1198	1873
95B, Law Enforcement	Male	153	204	—	791	1147
	Female	153	240	1166	1626	3185
	Overall	153	207	—	878	1360
All MOS Codes and Categories	Male	196	209	—	841	1246
	Female	120	228	1378	1743	3469
	Overall	189	211	—	930	1465

* Rates per 10,000; 1.28 million person years for men and 140,000 person years for women over the 5-year period. Individuals can be hospitalized more than once.

Source: TAIHOD query using DMDC and IPDS/PASBA data.

This work was supported by Defense Women's Health Research Program (Army Medical Research and Materiel Command) grant W4168044.

Inquiry 2: An Evaluation of the Risk Associated with Assignment to an Airborne Unit.*

- **Background.** Military parachuting remains one of the most hazardous activities for Army soldiers. Presently, close to 40,000 soldiers are assigned to jobs that require frequent parachute jumps (at least once per quarter). Airborne soldiers submit to more rigorous selection criteria in qualifying for airborne assignment, endure vigorous training programs, and are expected to maintain a high degree of physical fitness. Because these soldiers are also provided hazardous duty pay in recognition of their unique risks, they can be identified and isolated for comparison to other occupational groups of soldiers in the Army.
- **How TAIHOD Was Used.** The risk of hospitalization among airborne infantry soldiers was compared to the risk among an equivalent group of nonairborne infantry soldiers. Several components of the TAIHOD were linked to perform the analysis:
 - Hazardous duty files from the DMDC pay file database were used to identify soldiers exposed to regular parachute jumps.
 - Demographic variables from the DMDC personnel master files were used to identify a comparison group of infantry soldiers of similar MOS who are not exposed to parachuting.
 - All hospitalization records for both groups of these infantry soldiers were linked to the demographic and pay records in order to calculate hospitalization rates for various causes.

* Bricknell, M.C.M., P.J. Amoroso, and M.M. Yore. What is the risk associated with being a qualified military parachutist? *Occupational Medicine* 49(3):139-145, 1999.

- **Results.** Hospitalization for all causes was analyzed. The top 20 causes of hospitalization among infantry soldiers (parachutists vs. nonparachutists) for CY 1990-1994 are summarized in **Table 8-3**. The results indicate that parachute-qualified soldiers do indeed have higher rates of injury hospitalization, especially for head injuries, ankle fractures, and back injuries. These excess injuries appear to be related to parachuting, combat, and aircraft operations. As shown in **Table 8-4**, overall hospitalizations may be slightly lower than among their infantry counterparts, with significantly fewer hospitalizations for mental illness. This may reflect the generally higher level of health required for selection and sustained qualification for this elite duty.

Table 8-3. Rates of Top 20 Causes of Hospitalization Among Infantry Soldiers (Parachutists vs. Nonparachutists), CY 1990-1994

Causes of Hospitalization	Parachutists*			Nonparachutists†			Relative Risk§	95% Confidence Intervals
	Number	Rate Per 10,000 Person Years‡	Rank	Number	Rate Per 10,000 Person Years‡	Rank		
Internal derangement of the knee	348	58	1	1409	52	1	1.12	1.00-1.26
Other derangement of joint	219	37	2	800	30	6	1.24	1.07-1.44
Intracranial injury	214	36	3	294	11	25	3.30	2.77-3.94
Inguinal hernia	188	32	4	931	35	4	0.92	0.78-1.07
Fracture of the ankle	180	30	5	287	11	27	2.85	2.36-3.43
Adjustment reaction	159	27	6	1245	46	2	0.58	0.49-0.68
Disorder of tooth development and eruption	151	25	7	912	34	5	0.75	0.63-0.89
Alcohol dependence syndrome	143	24	8	1199	44	3	0.54	0.46-0.64
Other cellulitis and abscess	116	20	9	371	14	17	1.42	1.15-1.75
Other disorders of synovium, tendon, bursa	112	19	10	501	19	9	1.01	0.83-1.24
Pneumonia unspecified	105	18	11	547	20	7	0.87	0.71-1.07
Other disorders of bone and cartilage	104	18	12	433	16	11	1.09	0.88-1.35
Other non-infectious gastroenteritis and colitis	103	17	13	376	14	15	1.24	1.00-1.55
Fracture of vertebral column without mention of spinal cord injury	98	17	14	140	5	57	3.18	2.45-4.11
Other and unspecified disorders of joint	93	16	15	389	14	14	1.08	0.87-1.36
Effect of heat and light	92	15	16	206	8	39	2.03	1.59-2.59
Fracture of the face bones	86	14	17	329	12	21	1.19	0.94-1.50

Table 8-3.—Continued

Causes of Hospitalization	Parachutists*			Nonparachutists†			Relative Risks	95% Confidence Intervals
	Number	Rate Per 10,000 Person Years‡	Rank	Number	Rate Per 10,000 Person Years‡	Rank		
Deviated nasal septum	84	14	18	286	11	29	1.33	1.05-1.70
Intervertebral disc disorders	81	14	19	441	16	10	0.83	0.66-1.06
Injury, other and unspecified	79	13	20	201	7	43	1.78	1.38-2.31

* Parachutists = soldiers in receipt of parachute pay.

† Nonparachutists = soldiers not in receipt of parachute pay.

‡ A total of 329,794 person years were accounted for; of these, 18% were in the parachutist group. Individuals can be hospitalized more than once.

§ Relative risk of hospitalizations = hospitalization rate for parachutists/hospitalization rate for nonparachutists.

Source: TAIHOD query using DMDC and IPDS/PASBA data.

Table 8-4. Comparisons of Seven Top Hospitalization Causes Among Infantry Soldiers (Parachutists vs. Nonparachutists) by Major ICD-9 Diagnostic Group, CY 1990-1994

Major ICD-9 Diagnostic Group, Top Seven Code Groups	ICD-9 Codes	Parachutists*		Nonparachutists†		Relative Risk§	95% Confidence Interval
		Number of Hospitalizations‡	Hospitalization Rate‡ (n/10,000 person-years)	Number of Hospitalizations‡	Hospitalization Rate‡ (n/10,000 person-years)		
Injury	800-999	2,165	364	6,580	243	1.49	1.42-1.57
Musculoskeletal System	710-739	1,305	219	6,100	226	0.97	0.92-1.03
Digestive System	520-579	767	129	4,309	159	0.81	0.75-0.87
Respiratory System	460-519	587	99	3,199	118	0.83	0.76-0.91
V Codes	V01-V82	505	85	1,651	61	1.39	1.26-1.53
Mental Disorders	290-319	454	76	3,896	144	0.53	0.48-0.58
Infectious & Parasitic	001-139	379	64	1,934	72	0.89	0.80-0.99
All Hospitalizations #	—	7,378	1239	34,194	1265	0.98	0.96-1.00

* Parachutists = soldiers in receipt of parachute pay.

† Nonparachutists = soldiers not in receipt of parachute pay.

‡ A total of 329,794 person years were accounted for; of these, 18% were in the parachutist group. Individuals can be hospitalized more than once.

§ Relative risk of hospitalizations = hospitalization rate for parachutists/hospitalization rate for nonparachutists.

|| Supplementary classification includes nonspecific follow-up exams, vasectomy, and "other orthopedic aftercare."

Total reflects all hospitalizations for each group including those in major ICD-9 groups not displayed in this table.

Source: TAIHOD query using DMDC and IPDS/PASBA data.

Inquiry 3: The Association Between Seat Belt Use and Hospitalization for Motor Vehicle Crashes

- **Background.** Motor vehicle crashes remain one of the most important causes of injury and death for men and women in the military. Seat belts are a proven method for reducing injury in motor vehicle crashes. While seat belt usage among military service members is generally high, almost 40 percent of soldiers taking the HRA in CY 1992 admitted to wearing them less than 100 percent of the time. Low seat belt usage may contribute to injury either because the likelihood of injury given a crash is greater, or because admitting to low rates of use may indicate greater risk-taking behavior and therefore a greater likelihood of a crash.
- **How TAIHOD Was Used.** This behavioral choice was chosen for study because it has been shown to lend itself particularly well to intervention. The following components of the TAIHOD were queried:
 - Health Risk Appraisal Survey database. All survey respondents in CY 1992 were chosen for the study. Responses to the question "What percentage of the time do you usually buckle your safety belt when driving or riding?" were analyzed.
 - Demographic variables from the DMDC personnel database were used to determine age, rank, gender, and if and when respondents left Army service.
 - Hospitalization for STANAG injury cause codes related to private motor vehicles from CY 1992 (starting with their survey date) through December 1997 were matched to HRA records of the respondents.

- **Results.** Respondents were grouped into three categories based upon their reported percentage of seat belt usage. Approximately 64 percent reported 100 percent usage, 25 percent reported usage between 51 and 99 percent, and 11 percent reported usage of 50 percent or less. Low rates of seat belt usage were associated with significantly greater risk of injury. The low usage group was shown to have over twice the risk of injury hospitalization than the group who claimed 100 percent seat belt usage. **Table 8-5** summarizes the findings.

Table 8-5. Association Between Reported Seat Belt Use and Hospitalization for Motor Vehicle Crashes, CY 1990-1994

Seat Belt Usage (% of time)	Number	Percentage of Total	Number Hospitalized	Rate/10,000	Odds Ratio (95% Confidence Intervals)
100%	60,391	64%	187	31	—
51-99%	24,041	25%	107	45	1.4 (1.1, 1.8)
0-50%	10,491	11%	70	67	2.2 (1.6, 2.8)

Source: TAIHOD query using DMDC, IPDS/PASBA, and HRA data.

Bell, N.S.; Amoroso, P.J., M.M. Yore, G.S. Smith, and B.H. Jones. "Self-reported Risk-Taking Behaviors and Hospitalization for Motor Vehicle Injury Among Active Duty Army Soldiers," unpublished. This work was supported by NIAAA grant 1R29AA11407-01A1 and Defense Women's Health Research Program (Army Medical Research and Materiel Command) grant W4168044.

Inquiry 4: Risk Factors for Completed Suicide in the U.S. Army

- **Background.** As documented in Chapter 2, suicide is a significant cause of premature death in the U.S. Army (as well as the other services). Though suicide is preventable, high-risk individuals are often difficult to identify. The HRA survey has already been given to well over 500,000 active duty Army soldiers. Linking these self-reported data to deaths allows a number of potential risk factors to be assessed and potential intervention opportunities to be identified.
- **How TAIHOD Was Used.** The relationship of selected self-reported measures of social support, job satisfaction, and alcohol and tobacco use were analyzed as predictors of suicide-related death. To accomplish this analysis, several components of the TAIHOD were linked:
 - All active duty Army soldiers who took the HRA between CY 1989 and 1997 were followed in a retrospective cohort study.
 - The DMDC personnel master files were used to verify the active duty status of the respondents.
 - The casualty database (ACIPS) was linked to the records of the HRA takers to identify all suicides from CY 1989-1997.
- **Results.** Preliminary analyses suggest that multiple HRA questions predict risk of suicide. Several of these associations are displayed in **Table 8-6**. The results in **Table 8-6** demonstrate that self-reported health status measures can be linked to real outcomes, in this case, self-inflicted injury resulting in death. Advanced analyses (combining responses to multiple questions) will attempt to develop sophisticated prediction models to identify high-risk individuals for immediate intervention, preferably at the point of survey completion.

Table 8-6. Responses on the Health Risk Appraisal and Risk of Suicide*

Questions	Number of Respondents	Number of Deaths	Odds Ratio	95% Confidence Interval
Gender:				
Female	69,671	5	--	--
Male	438,071	139	4.6	(2.0, 10.0)
Rank:				
Officer/Warrant	91,138	7	--	--
Enlisted	349,218	134	5.0	(2.3, 11.7)
Personal misfortune in the past year?				
None	189,949	41	--	--
Some/few	255,007	74	1.3	(0.9, 2.0)
Several	56,074	29	2.4	(1.5, 4.0)
Family problems?				
Never	181,432	37	--	--
Sometimes	81,930	34	1.4	(0.9, 2.1)
Often	18,497	11	2.9	(1.4, 6.0)
People to turn to?				
Always	307,078	67	--	--
Sometimes	39,501	17	2.0	(1.1, 3.4)
Never	11,453	9	3.6	(1.7, 7.5)
Is life overwhelming?				
Never	463,154	122	--	--
Sometimes	24,390	16	2.5	(1.4, 4.3)
Often	2,791	3	4.1	(1.3, 12.8)
Cigarette use?				
Never	288,533	53	--	--
Ex-smoker	77,359	25	1.8	(1.1, 2.9)
Current smoker	141,547	67	2.6	(1.8, 3.8)
Considered suicide?				
No	488,568	130	--	--
Yes	11,810	14	4.5	(2.5, 8.0)
Do friends worry about your drinking?				
No	403,193	114	--	--
Yes	9,851	11	4.0	(2.0, 7.6)

* This work in progress represents a collaborative effort with researchers at USARIEM, SSDS, Inc., and the Harvard Injury Control Research Center, and is supported by NIAAA grant IR29AA11407-01A1, PHS/CDC grant R49/CCR115279-01 and Defense Women's Health Research Program (Army Medical Research and Materiel Command) grant W4168044.

8-8. Other Uses of the TAIHOD.

The resources presently devoted to prevent and control injuries among service members are relatively small, in part because quantification of the impact on the mission, readiness, and overall health of the Armed Forces is such a difficult challenge. Currently available tools were simply not available 5 or 10 years ago. The Army, as well as the other services, does an excellent job of collecting quality data on various populations; however, much of these data have been collected for purely administrative purposes. The TAIHOD affords an opportunity to make further use of these data sources for research purposes and serves as a model comprehensive research database for the development of future research databases in the public and private sectors.

Researchers will be able to do the following:

- Document the incidence, prevalence, and trends of injury among female and male soldiers by diagnostic category and location/body part.
- Document important causes of injuries.
- Determine the subpopulations at greatest risk of injury, including high-risk MOSs.
- Determine the relative morbidity and mortality from injuries vs. illness or disease.
- Estimate the direct and indirect costs associated with injuries and illnesses.
- Demonstrate the relationship between self-reported health habits and actual outcomes.
- Compare the Army rates of injury to nationally established population health objectives (Healthy People 2000 objectives).
- Identify important causes of premature discharge from the service.
- Recommend to policy makers and commanders injury and illness prevention program development, appropriate surveillance targets, and future research focus.
- Firmly establish a research database capable of informing research scientists of actual population outcomes prior to initiation of research on military populations.

CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS OF THE DoD INJURY SURVEILLANCE AND PREVENTION WORK GROUP

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Section I. Introduction

While we have known for some time that injuries in the U.S. Armed Forces are a significant problem, the full magnitude of the impact has not been defined. As this atlas reveals, injuries represent a far greater hazard to the health and readiness of the U.S. Armed Forces than any other medical threat. Since injuries represent the outcome of a sequence of probabilistic events, it is possible to quantitatively define events and design strategies to intervene at modifiable points. To prevent and control injuries, the military services must:

- Systematically collect and monitor surveillance data on injuries.
- Analyze the data to better understand the nature and causes of injuries.
- Establish intervention programs based on the analysis of this data.
- Follow up with evaluation research on intervention programs and outcomes.

This atlas demonstrates that abundant, high-quality data exists for all the services. Furthermore, the military's own success in reducing aviation and motor vehicle-related injuries clearly illustrates that the frequency and severity of injuries can be reduced. Additional strides must be made that capitalize on both the extraordinarily abundant data sources available to the military and the recent technological and methodological advances in injury prevention and control.

This final chapter:

- Outlines conclusions that summarize the findings of the DoD Injury Surveillance and Prevention Work Group regarding sources of information that illuminate the incidence and causes of injuries.
- Provides recommendations about how to use the information available on injuries in the U.S. Armed Forces to more effectively prevent their occurrence.

Section II. The Five-Step Public Health Approach

Whenever possible, established methodologies should be used to first understand and then counteract a given health threat. One methodology that can be used to prevent and control injuries is the five-step public health approach, shown in Figure 9-1. The appropriate activities for each step are also shown.

Five Steps of the Public Health Approach	
Steps	Appropriate Activities
1. Determine the existence and magnitude of the problem.	Surveillance
2. Identify the causes of and risk factors for the problem.	Research
3. Determine what prevents the problem.	Research/Intervention Trials
4. Implement prevention strategies and programs.	Policy, Behavioral Changes, and Equipment
5. Monitor and evaluate the effectiveness of prevention efforts.	Surveillance and Research

Figure 9-1. The Public Health Approach

Adapted from Mercy, J.A., M.L. Rosenberg, K.E. Powell, C.V. Broome, and W.L. Roper. "Public Health Policy for Preventing Violence." *Health Affairs*, Winter 1993:7-29, and Jones, B.H., and J.J. Knapik. "Physical Training and Exercise-Related Injuries: Surveillance, Research and Injury Prevention in Military Populations." *Sports Medicine*, 27(2):111-125, 1999.

The work group's conclusions and recommendations on the prevention and control of injuries are presented within the framework of this five-step approach. The work group was chartered to inventory and understand available data with injury surveillance potential. For this reason, the atlas and the conclusions outlined in this chapter focus on the first three steps of the process. The recommendations focus on general ways to use this information to implement more effective prevention programs (step 4). Finally, the atlas suggests how available data can be used, and to some extent is being used, to monitor the effectiveness of prevention strategies.

Section III. Conclusions

The work group's conclusions are outlined in this section. The outline follows the sequence of steps 1, 2, and 3 of the public health approach (see Figure 9-1).

Step 1. Determine the Existence and Magnitude of the Problem.

- Injuries are the leading cause of death (see Table 9-1).
- Deaths have decreased substantially from FY 1980-1995 primarily due to decreases in unintentional injury (accidental) deaths (see Table 9-2).
- Musculoskeletal (orthopedic) conditions are the leading cause of disability (see Table 9-3).
- As the leading cause of disability, musculoskeletal (orthopedic) conditions account for a large proportion of DoD disability costs (see page 9-9).
- Musculoskeletal (orthopedic) conditions are the leading cause of Veterans Administration disability payments (see Table 9-4).
- Injuries and musculoskeletal sequelae are the leading causes of hospitalization (see Table 9-5).
- Injuries are a major cause of morbidity associated with vigorous physical training (see page 9-11).

Step 2. Identify the Causes of and Risk Factors for the Problem.

- Vehicle accidents are the leading specific cause of death (see Table 9-6).
- Athletic or sports injuries, falls, and physical training are significant contributors to the occurrence of nonfatal injuries (see page 9-13).

Step 3. Determine What Prevents The Problem.

- Surveillance systems, research, and safety programs contribute to the prevention of injuries (see page 9-14).
- Data have been used to identify causes and to prevent injuries (see pages 9-14 and 9-15).

The prevention process begins with the determination that a problem exists. Routine surveillance is a critical starting point. Comprehensive medical surveillance, such as the military services are capable of, not only serves to identify health problems but provides the foundation for prioritizing prevention and research activities. Data in this atlas unequivocally show that injuries are the leading health hazard confronting military personnel. This deserves great attention from commanders and safety, research, and medical personnel, among others.

Step 1. Determine the Existence and Magnitude of the Problem.

Injuries are the leading cause of death.

The conclusion that injuries are the leading cause of death—specifically deaths caused by accidental injuries and violent injuries (suicides and homicides combined)—is supported by data provided in Chapter 2 and summarized in Table 9-1.

Table 9-1. Injuries are the Leading Cause of Death in the U.S. Armed Forces

Casualty Types	Army	Navy	Marine Corps	Air Force
Accidental Injuries	<ul style="list-style-type: none"> • Accidental injuries account for 49% of all deaths. 	<ul style="list-style-type: none"> • Accidental injuries account for 48% of all deaths. 	<ul style="list-style-type: none"> • Accidental injuries account for 57% of all deaths. 	<ul style="list-style-type: none"> • Accidental injuries account for 47% of all deaths.
Violent Injuries (Suicides and Homicides Combined)	<ul style="list-style-type: none"> • Violent injuries account for 27% of all deaths: suicides - 18%; homicides - 9%. 	<ul style="list-style-type: none"> • Violent injuries account for 28% of all deaths: suicides - 20%; homicides - 8%. 	<ul style="list-style-type: none"> • Violent injuries account for 29% of all deaths: suicides - 20%; homicides - 9%. 	<ul style="list-style-type: none"> • Violent injuries account for 30% of all deaths: suicides - 26%; homicides - 4%.
Combination of Accidental and Violent Injuries	<ul style="list-style-type: none"> • Accidental and violent injuries account for 76% of all deaths. 	<ul style="list-style-type: none"> • Accidental and violent injuries account for 76% of all deaths. 	<ul style="list-style-type: none"> • Accidental and violent injuries account for 86% of all deaths. 	<ul style="list-style-type: none"> • Accidental and violent injuries account for 77% of all deaths.

Sources: Atlas Chapter 2, tables 2-4, 2-7, 2-9, 2-11, and 2-12.

Deaths have decreased substantially from FY 1980-1995 primarily due to decreases in accidental (unintentional injury)* deaths.

The conclusion that deaths decreased from FY 1980-1995 due to substantial decreases in accidental deaths is supported by data provided in Chapter 2 and summarized in Table 9-2.

Table 9-2. Decrease in Deaths in the U.S. Armed Forces from FY 1980-1995

	Army	Navy	Marine Corps	Air Force
Deaths	• Deaths decreased 34%.	• Deaths decreased 52%.	• Deaths decreased 55%.	• Deaths decreased 44%.
Accidental Deaths	• Accidental deaths decreased 46%.	• Accidental deaths decreased 68%.	• Accidental deaths decreased 54%.	• Accidental deaths decreased 60%.

Sources: Atlas Chapter 2, figures 2-11, 2-12, 2-15, 2-16, 2-19, 2-20, 2-23, and 2-24.

* While the terms "accident" and "accidental injuries" are commonly used in the military by the casualty office and safety community, public health officials in the U.S. recommend using the term "unintentional injury." The reason for this recommendation is to emphasize that injuries are not random, uncontrollable events (i.e., accidents), but can be predicted and prevented.

Musculoskeletal (orthopedic) conditions are the leading cause of disability.

The conclusion that musculoskeletal (orthopedic) conditions are the leading cause of disability is supported by data provided in Chapter 4 and summarized in Table 9-3.

Table 9-3. Musculoskeletal (Orthopedic) Conditions are the Leading Cause of Disability in the U.S. Armed Forces

Disability	Army	Navy and Marine Corps	Air Force
Musculoskeletal (Orthopedic) Conditions (VASRD Codes 5000-5300)	<ul style="list-style-type: none"> Musculoskeletal (orthopedic) conditions account for 53% of all disabilities. 	<ul style="list-style-type: none"> Musculoskeletal (orthopedic) conditions account for 63% of all disabilities. 	<ul style="list-style-type: none"> Musculoskeletal (orthopedic) conditions account for 22% of all disabilities.
Mental Disorders (VASRD Codes 9200-9500)	<ul style="list-style-type: none"> Mental disorders are the second leading cause of disability, accounting for 14% of all disabilities. 	<ul style="list-style-type: none"> Mental disorders are the second leading cause of disability, accounting for 10% of all disabilities. 	<ul style="list-style-type: none"> Mental disorders are the second leading cause of disability, accounting for 21% of all disabilities.
Ratio	<ul style="list-style-type: none"> Musculoskeletal (orthopedic) conditions occur almost 4 times as often as mental disorders, the second leading cause of disability. 	<ul style="list-style-type: none"> Musculoskeletal (orthopedic) conditions occur more than 6 times as often as mental disorders, the second leading cause of disability. 	<ul style="list-style-type: none"> Musculoskeletal (orthopedic) conditions occur slightly more often as mental disorders, the second leading cause of disability.

Source: Atlas Chapter 4, tables 4-3 and 4-9.

As the leading cause of disability, musculoskeletal (orthopedic) conditions account for a large proportion of DoD disability costs.

The conclusion that injuries are costly to DoD and the leading cause of musculoskeletal (orthopedic) conditions is supported by data in Chapter 4 and summarized below.

- The costs of injuries are great, in terms of both manpower losses and monetary expenditures.
- The DoD pays over \$1.5 billion per year to disabled service members. Musculoskeletal (orthopedic) conditions account for 40-50% of this amount.

Musculoskeletal (orthopedic) conditions are also the leading cause of Veterans Administration disability payments.

The conclusion that musculoskeletal (orthopedic) conditions are the leading cause of Veterans Administration disability payments is supported by data provided in Chapter 4 and summarized in Table 9-4.

- The Department of Veterans Affairs pays disability compensation in excess of \$12 billion per year (\$1 billion per month), with musculoskeletal (orthopedic) conditions accounting for 45% of all disability cases and 34% of disability payments (based on December 1994 data).

Table 9-4. Injuries are the Leading Cause of Veterans Administration Disability Payments

Disability	Disability Compensation Costs	
	% of Total	Millions of Dollars
Musculoskeletal (Orthopedic) Conditions (VASRD Codes 5000-5300)	<ul style="list-style-type: none"> • Musculoskeletal (orthopedic) conditions account for 34% of all disability compensation costs. 	<ul style="list-style-type: none"> • Musculoskeletal (orthopedic) conditions account for a third of all disability costs—\$346.8 million per year.
Mental Disorders (VASRD Codes 9200-9500)	<ul style="list-style-type: none"> • Mental disorders account for 26% of all disability compensation costs. 	<ul style="list-style-type: none"> • Mental disorders account for a quarter of all disability costs—\$265.2 million per year.
Ratio	<ul style="list-style-type: none"> • Musculoskeletal (orthopedic) conditions occur 1 1/3 times more often than mental disorders, the second leading cause. 	<ul style="list-style-type: none"> • Musculoskeletal (orthopedic) conditions cost 1 1/3 more than mental disorders.

Source: Atlas Chapter 4, Table 4-12.

Injuries and musculoskeletal sequelae are the leading causes of hospitalization.

The conclusion that injuries—specifically chronic or late musculoskeletal system conditions and acute injuries—are the leading causes of hospitalization is supported by data provided in Chapter 5 and summarized in **Table 9-5**.

Table 9-5. Injuries and Musculoskeletal Sequelae are the Leading Causes of Hospitalization in the U.S. Armed Forces

Principal Diagnosis Groups	Army	Navy	Marine Corps	Air Force
Musculoskeletal System (ICD-9 Codes 710-739)	<ul style="list-style-type: none"> Musculoskeletal system accounts for 18% of all hospitalizations. 	<ul style="list-style-type: none"> Musculoskeletal system accounts for 22% of all hospitalizations. 	<ul style="list-style-type: none"> Musculoskeletal system accounts for 28% of all hospitalizations. 	<ul style="list-style-type: none"> Musculoskeletal system accounts for 14% of all hospitalizations.
Injury (ICD-9 Codes 800-999)	<ul style="list-style-type: none"> Injury accounts for 10% of all hospitalizations. 	<ul style="list-style-type: none"> Injury accounts for 2% of all hospitalizations. 	<ul style="list-style-type: none"> Injury accounts for 3% of all hospitalizations. 	<ul style="list-style-type: none"> Injury accounts for 8% of all hospitalizations.
Combination of Musculoskeletal System and Injury	<ul style="list-style-type: none"> Musculoskeletal system and injury account for 28% of all hospitalizations. 	<ul style="list-style-type: none"> Musculoskeletal system and injury account for 24% of all hospitalizations. 	<ul style="list-style-type: none"> Musculoskeletal system and injury account for 31% of all hospitalizations. 	<ul style="list-style-type: none"> Musculoskeletal system and injury account for 22% of all hospitalizations.

Source: Atlas Chapter 5, Table 5-21.

Injuries are a major cause of morbidity associated with vigorous physical training.

The conclusion that injuries are a major cause of morbidity resulting from strenuous training activities is supported by data in Chapter 6 and summarized below.

- Studies of Army basic training populations have shown that 23-27% of men and 42-67% of women are injured during the 8-week basic training cycle.
- Among men and women in Army basic training, injuries result in more days of limited duty than illnesses.
- In a sample of trainees in Navy boot camp (1995), 11% of the men and 22% of the women were injured during the 9 weeks of basic training.
- In a sample of Marine recruits (1995), 25% of the men and 29% of the women were injured during the 11-13 weeks of basic training.
- In both Army and Navy recruit populations, overuse injuries account for 70-80% of all injuries sustained during training.
- Among men and women in Air Force basic training, 15% of the male trainees and 33% of the female trainees were injured at least once during the 6 weeks of training.

Step 2. Identify the Causes of and Risk Factors for the Problem.

Vehicle accidents are the leading specific cause of death in the U.S. Armed Forces.

The conclusion that vehicle accidents are the leading specific cause of death in the U.S. Armed Forces is supported by data provided in chapters 2 and 3 and summarized in **Table 9-6**.

Table 9-6. Vehicle Accidents are the Leading Specific Cause of Death in the U.S. Armed Forces

Cause of Death	Army	Navy	Marine Corps	Air Force
Leading Specific Cause of Death	<ul style="list-style-type: none"> Vehicle accidents account for 32% of all deaths. 	<ul style="list-style-type: none"> Vehicle accidents account for 32% of all deaths. 	<ul style="list-style-type: none"> Vehicle accidents account for 41% of all deaths. 	<ul style="list-style-type: none"> Vehicle accidents account for 31% of all deaths.*
Second Leading Specific Cause of Death	<ul style="list-style-type: none"> Gunshots account for 21% of all deaths. 	<ul style="list-style-type: none"> Gunshots account for 19% of all deaths. 	<ul style="list-style-type: none"> Gunshots account for 20% of all deaths. 	<ul style="list-style-type: none"> Suicides account for 30% of all deaths.†
Ratio	<ul style="list-style-type: none"> Vehicle accidents occur almost 1½ times as often as deaths by gunshot. 	<ul style="list-style-type: none"> Vehicle accidents occur more than 1½ times as often as deaths by gunshot. 	<ul style="list-style-type: none"> Vehicle accidents occur more than 2 times as often as deaths by gunshot. 	<ul style="list-style-type: none"> Vehicle accidents occur only slightly more often than suicides.

* Vehicle accidents for the Air Force include POV auto, motorcycle, pedestrian, and other.

† Air Force data provided did not separate gunshots as a category.

Sources: Atlas Chapter 2, tables 2-5, 2-7, 2-9, 2-11, and 2-14; Chapter 3, tables 3-4, 3-8, 3-11, and 3-14.

Athletic or sports injuries, falls, and physical training are significant contributors to the occurrence of nonfatal injuries.

- Army Safety Center data indicate that sports are the largest contributor to the personnel injury category for Class A to C mishaps.
- Cause of injury data from hospitalization records show that athletic and sports injuries were the leading and third highest causes of injury, respectively, for both the Army and Air Force.
- Hospital data also show that falls are an important cause of morbidity.
- Army data show that physical fitness parameters, such as slow initial physical fitness test run time (low aerobic fitness levels) and behavioral factors such as smoking, are potentially modifiable risk factors for injury during training.
- Excessive physical training is itself a primary but modifiable cause of injury.

Step 3. Determine What Prevents The Problem.

Surveillance systems, research, and safety programs contribute to the prevention of injuries.

Data from the military service safety centers and medical research organizations illustrate the successful use of surveillance and the need for research in the prevention process. Safety data systems for all of the services have been critical to the great success of programs to prevent motor vehicle and aviation crash fatalities and injuries (source: Chapter 3). The safety centers have employed information from these systems to monitor rates and trends of motor vehicle and aviation crashes and to institute progressively more effective prevention programs.

Data have been used to identify causes and prevent injuries.

- Naval Safety Center data show that Navy and Marine Corps aviation fatality rates decreased 96% from 54 per 100,000 flight hours in FY 1951 to 2 per 100,000 flight hours in FY 1995. The Navy placed a sequence of programs into effect to successfully achieve the demonstrated improvements, ranging from redesign of carrier decks to intensive training for both ground and flight crews (source: Chapter 3).
- Air Force private motor vehicle fatality rates decreased 47% from FY 1980-1994. The significant decrease in private motor vehicle fatality rates is attributed to a combination of factors, chief of which are the continued positive influence of the Standard Traffic Safety Course and Local Conditions Course, as well as intensive seasonally focused safety campaigns and strong commander emphasis. The Army employed similar strategies and their rates have similarly declined (source: Chapter 3).

- Safety center data show decreases in—
 - Accidents/mishaps and accident/mishap-related fatality rates for all services (source: Chapter 3).
 - Motorcycle-related deaths by approximately 60% for the Army and Navy over a 13- to 15-year period, respectively (source: Chapter 3).
 - Privately owned motor vehicle fatality rates from 38-58% over a 14-15 year period for the Army, Navy, and Air Force (source: Chapter 3).

Military medical research programs have identified a number of potentially modifiable risk factors for injuries and have successfully tested a number of interventions. Recent research by the U.S. Army Research Institute of Environmental Medicine (USARIEM) and the Naval Health Research Center (NHRC) has identified a number of areas where programs have worked to prevent injuries (source: Chapters 6 and 8). Examples of research contributing to prevention of injuries include:

- Research identified physical training and vigorous operational activities as the most common causes of injuries requiring patient care and limited duty (source: Chapter 6).
- Army research in the 1980s suggested that there are thresholds in the amount of running above which physical fitness does not improve but injury rates continue to climb (source: Chapter 6).
- Research on Marine Corps recruits by the NHRC shows that reductions in the amount of running and gradual progression of intense physical training can effectively reduce the incidence of stress fractures without sacrificing physical fitness (source: Chapter 6).

- Research on Army Airborne School candidates showed that an outside-the-boot ankle brace could reduce the incidence of parachute jump-related ankle sprains by as much as 85%. The annual cost avoidance if braces are worn by all Army jumpers would exceed \$2.5 million* (source: Chapter 6).
- Subsequent research has shown that outside-the-boot ankle braces can effectively prevent ankle injuries among Army rangers during tactical operations without impeding mission success (not yet published).
- Studies of seat belt use in the Army indicate that soldiers who always wear their seat belts are 50% less likely to be hospitalized than soldiers who buckle up less than half the time (source: Chapter 8).
- Other studies identify modifiable risk factors that could potentially be used to design intervention strategies. Some of these findings include:
 - Basic trainees who have the lowest levels of fitness on entry to the military are at greater risk of injury during basic training (source: Chapter 6).
 - Trainees who are the least physically active prior to entering the service are at greater risk of injury during basic training (source: Chapter 6).
 - Basic trainees who smoke cigarettes experience significantly more injuries than those who do not (source: Chapter 6). This has been shown to be true for infantry soldiers as well.†
 - Soldiers with certain knee injuries are at substantially higher risk of disability discharge (source: Chapter 4).

Medical research also illustrates why it is so important to test unproven strategies to prevent injuries. In 1985, the Marine Corps felt that recruits were experiencing an epidemic of stress fractures and that shock absorbent boot insoles would prevent the problem. A rigorous randomized intervention trial showed that injury incidence was the same among Marines who wore insoles as compared to those who did not. The insoles were shown to be ineffective at preventing injuries, thus saving the Marine Corps an unnecessary expense.

* Amoroso, Paul J. et al. "Braced for Impact: Reducing Military Paratroopers' Ankle Sprains Using Outside-the-Boot Braces." *Journal of Trauma: Injury, Infection, and Critical Care* 45(3):575-580, 1998.

† Reynolds, K., H.A. Heckel, C.E. Witt, J.W. Martin, J.A. Pollard, J.J. Knapik, and B.H. Jones. "Cigarette Smoking, Physical Fitness, and Injuries in Infantry Soldiers." *Am. J. Prev. Med.* 10:145-160, 1994.

Section IV. Recommendations for Future Surveillance, Prevention of Injuries, and Monitoring Program Successes

The work group recommendations relate to how the data and data sources reviewed should be used in the process of implementing prevention programs (Step 4) and monitoring and evaluating the efficiency/success of the programs (Step 5) (see Figure 9-1).

Step 4. Implement Prevention Strategies and Programs.

- Use surveillance to routinely prioritize prevention and research targets (see page 9-18).
- Enhance the Defense Medical Surveillance System capabilities to routinely conduct injury and other surveillance (see page 9-18).
- Ensure adequate injury research to support prevention programs (see page 9-19).
- Get surveillance and research information to those who can act to prevent injuries (see page 9-20).
- Establish an Injury Advisory Council (see page 9-21).
- Establish a DoD Injury Research Center (see page 9-21).
- Mobilize support of commanders and policy makers (see page 9-21).

Step 5. Monitor and Evaluate the Effectiveness of Prevention Efforts.

- Use multiple data sources to track rates and trends of injuries and to monitor the effectiveness of interventions to prevent injuries (see page 9-22).
- Enhance injury evaluation research support (see page 9-22).
- Routinely monitor and evaluate efficacy of prevention programs (see page 9-23).

Step 4. Implement Prevention Strategies and Programs.

Use surveillance to routinely prioritize prevention and research targets.

- Focus on priority targets—motor vehicle accidents, training injuries, sports, falls, and other causes as they are identified.
- Use surveillance to determine the most important targets for prevention.
- Enhance surveillance of deaths to include specific medical causes and circumstances of death to identify preventable factors and prioritize prevention programs. This can best be accomplished through the establishment of a DoD Medical Mortality Registry to track medical and circumstantial information for all military deaths.
- Produce a prioritized list of injury targets for prevention and research (based on incidence/rates and severity/time loss).
- Where “off the shelf” prevention strategies exist, they should be employed. Where such ready solutions do not exist, research is the most appropriate response to serious problems.
- Determine adequacy of epidemiology, occupational health, industrial hygiene, ergonomic, and other services needed to support injury prevention efforts made by commanders, supervisors, and others.

Enhance the Defense Medical Surveillance System capabilities to routinely conduct injury and other surveillance.

- Integrate medical outcomes across the full spectrum of health from mild and moderate to severe and fatal.
 - Incorporate deaths and routinely code deaths and the nature and causes of injuries using ICD-9 or ICD-10 codes.
 - Incorporate disabilities.
- Improve outpatient data with better and more complete coding of diagnoses and addition of cause codes.

- Capture and integrate deployment data.
- Standardize data collection and coding across services.
 - Collect better primary data to include the minimum basic data set variables for intentional injuries ("cause data with associated events").*
 - Link Physical Evaluation Board and Medical Evaluation Board data to other medical databases (numerators) and population databases (denominators).
 - Improve cause-of-injury coding in the hospital system. Take better advantage of coding for duty-related injuries as well as free text fields describing injuries. Code cause and ICD-9, or a hybridized system with STANAG (for the military aspects (i.e., war coding)). Plan for transition to ICD-10 coding.
 - Standardize the way injuries get coded for reporting across services and databases.
 - Assure adequate collection of cause data to include possible external coding for musculoskeletal system conditions.
- Develop practical automated unit-based surveillance tools for commanders (injury profile/time loss tracking).
- Integrate hazard (agent/cause) and exposure/risk factor (environment and host) surveillance data with medical outcome and population data.

Ensure adequate injury research to support prevention programs.

- Research is needed to demonstrate what actually works to prevent injuries.
- Focus research on high-risk populations and environments with largest impact on readiness.
- Allocate and prioritize resources for research based on the magnitude and severity of medical problems—injuries clearly deserve greater priority.
- Allocate adequate resources to ensure viability of injury research programs within the medical departments.
- Maintain the capability to systematically conduct research on the most important injury threats (e.g., motor vehicle crashes, sports, falls, training injuries, work-related injuries, etc.), as well as newly identified or emerging threats.

* Armed Forces Epidemiological Board, Injuries in The Military: A Hidden Epidemic, 1996.

- Further broaden the research effort to include operational populations as well as basic training and infantry populations.
- Concentrate research on physical training practices and the intensity, frequency, and duration of training, as well as the type of activity.
- Continue to explore the association of injury with training practices, fitness, performance, smoking, alcohol use, and other risk-taking behaviors.
- Conduct research to develop biomechanically sound equipment (boots, shoes, parachute ankle braces, etc.).

Get surveillance and research information to those who can act.

- Coordinate the efforts of trained specialists in epidemiology, social and behavioral sciences, biomechanics and engineering, medicine, public health, statistics, law enforcement, occupational health, safety, military command, and others for effective and comprehensive surveillance, research, and safety program implementation.
- Use the safety network and the military chain of command to provide safety advice and information based on science (surveillance and research results). For example, both Army and Navy research on training populations suggests that poor entry-level aerobic fitness is a risk factor for injury. This scientifically based knowledge can be used by the chain of command to support efforts to reduce injuries by instituting interventions to better prepare individuals to withstand the rigors of military training.
- Make injury data on hospitalizations due to accidents routinely accessible to the safety centers.
- Provide surveillance data and expert consultation as decision support to those who can act to prevent injuries (commanders, supervisors, safety centers, and others) on a routine basis.
- Use the Internet as a means of enhancing data availability. Many organizations have already chosen to make data available from a web site.
- Develop feedback systems from safety centers and commanders to surveillance and research centers.

- Provide feedback to DoD and service safety programs, commanders, and policy makers, etc., on successes and failures of prevention initiatives as documented by rates and trends of key injuries and diseases.
- Update relevant DoD directives and instructions to require the monitoring and use of the full spectrum of available injury data.

Establish an Injury Advisory Council.

- Include safety, research, surveillance, and other key representatives from each of the services.
- Meet routinely (at least annually) to review surveillance and current research data and evaluate progress toward key prevention goals as measured by monitoring outcome data (surveillance data) and programmatic assessments.

Establish a DoD Injury Research Center.

- Create a research center with the “critical mass” and diversity of scientific expertise necessary to understand and prevent the complex problems of injuries.
- Address cross-cutting injury problems of the services, such as motor vehicle crashes and physical training injuries.
- Address service-specific injury problems.

Mobilize support of commanders and policy makers.

- Using surveillance and research data, demonstrate that prevention of injuries can cut medical and disability costs, reduce lost duty time, and improve the readiness of troops.
- Convince commanders that prevention starts with them.
- Reinforce safety initiatives to incorporate risk management and prevention in all military operations.
- Establish a partnership among integrated surveillance systems; research communities/organizations; safety centers; and commanders, policy makers, and other decision makers.

Step 5. Monitor and Evaluate the Effectiveness of Prevention Efforts.

Use multiple data sources, such as those described in this atlas, to track rates and trends of injuries and to monitor the effectiveness of interventions to prevent injuries. For example:

- To get a broad, overall picture of injury fatality rates in each of the services, use the accidental death rates that are routinely tracked and reported by the Directorate of Information Operations and Reports (DIOR), Washington Headquarters Service (source: Chapter 2). These would be greatly enhanced if more detailed cause and circumstance of death information were collected.
- To track disabilities due to injuries, use the rates and trends of musculoskeletal (orthopedic) conditions available in the disability agency databases (source: Chapter 4).
- To monitor injuries due to specific causes, refer to the safety center databases or external cause-of-injury codes in hospitalization databases (source: Chapters 3 and 5).
- To determine the effect of an intervention on injury hospitalization rates, use injury and musculoskeletal system categories in the hospitalization databases (source: Chapter 5).
- To evaluate the effect of an intervention on a specific subset of the military population, use:
 - Research databases that provide historical injury rates to be compared to current injury rates.
 - Surveillance databases capable of identifying specific units (source: Chapter 6).

Enhance injury evaluation research support.

- Foster development of integrated DoD research databases such as the Total Army Injury and Health Outcomes Database (TAIHOD) to directly link personnel records, self-reported health habits, exposure data, and other factors to specific health outcomes, and to trace the interrelationship of these outcomes over time (e.g., Army personnel who sporadically or never use seat belts are twice as likely to be injured). Using carefully structured data queries, such databases would support epidemiological health research in injury control, occupational hazards, health promotion, and disease prevention (source: Chapter 8), and would permit evaluations of intervention effectiveness.

- Enhance research capabilities of existing military medical research organizations such as the NHRC and USARIEM (source: Chapter 8).
- Develop registries such as the Defense and Veterans Head Injury Program (DVHIP) to collect better, more complete data for serious and costly injuries (e.g., head injuries, spinal cord injuries, knee injuries, etc.). The DVHIP is a unique collaboration of the DoD, Department of Veterans Affairs, and Brain Injury Association (BIA). The DVHIP's mission is to ensure that all military and DVA traumatic brain injury (TBI) patients receive TBI-specific evaluation and follow-up, while at the same time collecting standardized patient outcome data. This data collection allows for the comparison of the efficacy and cost of various TBI treatment and rehabilitation strategies, and helps define optimal care for victims of TBI (source: Chapter 7).

Routinely monitor and evaluate efficacy of prevention programs.

- Determine adequacy of epidemiology, occupational health, industrial hygiene, ergonomic, and other investigative and prevention services needed to support injury prevention initiatives started by commanders, supervisors, and others (develop prioritization criteria).
- Once prevention strategies and programs are in place, employ surveillance systems and other quantitative tools for assessment to determine the effect of interventions on rates and trends of targeted medical outcomes. For example:
 - Confirm decrease in rates of death and hospitalizations due to motor vehicle crashes related to specific interventions.
 - Confirm lower rates of ankle injuries when parachute ankle braces are worn.
- Monitor and evaluate prevention program processes.
 - Improvement in knowledge and understanding of educational/training materials (e.g., principles of physical fitness and training injuries).
 - Greater use of prevention devices/strategies (e.g., percentage of service members using seat belts or percentage of airborne troops wearing ankle braces).

- Provide feedback to DoD and service safety programs, commanders, policy makers, etc., on successes and failures of prevention of routinely monitored rates and trends of key injuries.
- Appropriate funding for injury prevention programs commensurate with the magnitude of the problem.

Section V. Data Sources

This atlas demonstrates that a wide variety of databases exist that could be more effectively used to further prevent and/or reduce the impact of injuries on the health and readiness of the U.S. Armed Forces. Key information sources and systems used in the atlas data acquisition process include:

- Air Force Casualty Accountability System.
- Air Force Medical Support Agency, Medical Information Systems Division (AFMSA/SGSI).
- Air Force Mishap Information System (AFMIS).
- Air Force Personnel Data System.
- Ambulatory Data System (ADS).
- Army Casualty Information Processing System (ACIPS).
- Army Individual Patient Data System (IPDS).
- Army Medical Surveillance Activity (AMSA)/Defense Medical Surveillance System (DMSS).
- Army Physical Disability Case Processing System (PDCAPS).
- Army Safety Management Information System (ASMIS).
- Defense and Veterans Head Injury Program (DVHIP).
- Defense Manpower Data Center (DMDC).
- Directorate for Information Operations and Reports (DIOR), Washington Headquarters Service (WHS).
- DoD Worldwide Casualty System (WCS).
- Health Risk Appraisal (HRA) Data Set.
- Marine Corps Casualty Assistance Information System (CAIS).

- Marine Corps Ground Mishap Information System (GMIS).
- Naval Council of Personnel Boards.
- Naval Health Research Center (NHRC).
- Naval Medical Information Management System.
- Navy and Marine Corps Physical Evaluation Tracking System (PETS).
- Navy Automated Casualty Monitoring Program (ACMP).
- Navy Medical Evaluation Board.
- Navy Medical Information Management Center (NMIMC).
- Navy Safety Information Management System (SIMS).
- Total Army Injury and Health Outcomes Database (TAIHOD).
- U.S. Army Research Institute of Environmental Medicine (USARIEM).

Communication among all these systems should be improved and electronically integrated into a comprehensive medical surveillance system.

Section VI. Summary

The DoD Injury Surveillance and Prevention Work Group established these objectives at its first meeting in December 1992:

- Identify existing casualty, safety, medical, and personnel databases across all services.
- Collect and summarize data from these databases.
- Assess the value of these databases to injury surveillance.
- Document the magnitude of the injury problem—from outpatient visits to deaths—for all services.
- Present these data in a format that would demonstrate each database's utility as an injury and prevention surveillance tool.
- Make recommendations for future surveillance, research, and prevention of injuries.

In fulfilling its charter, the work group provided the data it collected to the Armed Forces Epidemiological Board (AFEB). The AFEB, in turn, chartered a work group of civilian experts to evaluate the data on injuries and to make recommendations for injury prevention. The AFEB Injury Work Group report, *Injuries in the Military: A Hidden Epidemic*, complements this *Atlas of Injuries in the U.S. Armed Forces*. The AFEB injury experts made specific recommendations for enhancing the surveillance and research capabilities of the services.

The AFEB report also influenced the establishment of a comprehensive DoD medical surveillance system that integrated many of the databases described in this atlas and that met Corporate Information Management system requirements.

This *Atlas of Injuries in the U.S. Armed Forces* fulfills the final objectives by defining the tremendous impact injuries have on the health and readiness of our military forces, and illustrates the wealth of data sources available for use in the injury prevention process. This final chapter provides insights into how they might be used to control the problem with injuries confronting the U.S. Armed Forces.

APPENDIX A

CLASSIFICATION CODES

Table A-1. Standardization Agreement (STANAG) 2050 Codes	A-2
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Table A-1. Standardization Agreement (STANAG) 2050 Codes

	Trauma Codes
0	Direct result of action by or against an organized enemy
1	Other battle casualties
2	Result of intervention of legal authority
3	Assault, or intentionally inflicted by another person
4	Intentionally self inflicted
5	Occurring while off duty, e.g., leave, pass, absent without leave (AWOL), etc.
6	Schemes and exercises
7	All other scheduled training, e.g., basic training, assault courses, etc.
8	Occurring while on duty
9	Unknown whether on or off duty

Code Groups	Category Descriptions
000-059	Accidents in air transport
000-029	Involving military aircraft
000-009	Powered heavier-than-air fixed wing
010-016	Rotary-wing

Table A-1.—Continued

Code Groups	Category Descriptions
017-019	Other
021-026	Parachuting, not because of aircraft damage or failure
028-029	Person not making flight but injured incident to aircraft accident
030-039	Involving nonmilitary and unspecified aircraft
030-033	While making flight
034-035	While boarding or alighting from
039-039	Person not making but injured incident to aircraft accident
040-049	Accident involving spacecraft
040-046	Astronaut was in spacecraft
047-049	Person not making but injured incident to aircraft accident
050-059	Escape system injuries
100-149	Accidents in land transport
100-119	Motor vehicle traffic accidents
100-109	Accident not involving military-owned vehicles (or unspecified ownership)
110-119	Accident involving military-owned vehicle
120-149	Land transport accidents, except motor vehicle traffic accidents

Table A-1.—Continued

Code Groups	Category Descriptions
120-139	Motor vehicle non-traffic accident
140	Railway accident
141-148	Other land transport accident
149	Other specified land transport accident
150-199	Accidents in water transport
150-159	Water transport accident, involving submersion
160-164	Accident involving falling, twisting, turning, slipping, running without falling
170-172	Accident involving machinery
190-199	Other water transport accidents
191	Noxious fumes
191	Excessive heat
193	Inadequate ventilation
195	Driving accident
197	Radiation injury or other nuclear accident
200-249	Athletics and sports
201-219	Occurring onboard ship

Table A-1.—Continued

Code Groups	Category Descriptions
220-239	Athletics and sports accident (including unspecified place of occurrence)
250-299	Reactions, complications, and misadventures in medical or surgical procedures, late complications, effects
250-269	Complications of prophylactic inoculation
270-279	Complications of other diagnostic, non-therapeutic medical or surgical procedure (includes adverse reaction or misadventure)
280-289	Complications of other therapeutic medical or surgical procedure (includes adverse reaction or misadventure)
290-298	Late complications or late effects
299	Late complications or late effects of old injuries
300-479	Instrumentalities of war, when employed by the enemy in war time
300-329	Agents of nuclear warfare
300-309	Injuries at time of explosion
310-311	Injuries subsequent to time of explosion
320-339	Agents of chemical warfare (excludes incendiaries) [can be subdivided]*
340-349	Agents of biological warfare
400-419	Conventional weapons injury to occupant of aircraft

Table A-1.—Continued

Code Groups	Category Descriptions
420-439	Conventional weapons injury to person on board ship
440-459	Conventional weapons injury to person on land or in unspecified location
460-479	Indirect or secondary effects of instrumentalities of war
480-499	Accidents in connection with own instrumentalities of war, when employed as such in wartime
480	Own nuclear weapons
481	Own chemical warfare agents
486-487	Own rockets, missiles, etc., and launching mechanisms
488-489	Own bombs, artillery, etc., and launching mechanisms
490	Own mines, torpedoes, etc.
491	Own small arms fire
492	Explosion of own munitions
493	Explosion of own weapons
494-495	Explosion of discharge of own weapon (noise, pressure) and mechanism
496-499	Other and unspecified
50*-59*	Guns, explosives, and related agents, except when used as instrumentalities of war in wartime

Table A-1.—Continued

Code Groups	Category Descriptions
50*	Nuclear weapons
51*	Chemical warfare agents
52*	Biological warfare agents
53*	Rockets and missiles
54*	Bombs, artillery, and other projectiles
55*	Mines
56*	Bullets or other projectiles from small arms weapons
57*	Explosion in the handling of ammunitions or other munitions
58*	Mechanism of small arms
59*	Other or unspecified
60*-69*	Machinery, tools, and selected agents
60*	Machinery
61*	Tools
62*	Electric current
63*	X-ray, radium, or other radioactive substance
64*	Cutting or piercing instruments

Table A-1.—Continued

Code Groups	Category Descriptions
65*	Explosion of pressure vessel
66*	Falling or projected object or missile
67*	Static objects
68*	Foreign objects entering body orifice
69*	Shoes, clothing, etc.
70*-79*	Poisons, fire, hot or corrosive substances
70*	Poisoning by ingestion of toxic substance
71*	Poisoning by inhalation of toxic substance
72*	Adverse systematic or skin reaction by contact with toxic substance
73*	Sting or bite of venomous reptile
74*	Sting or bite of venomous arthropod
75*	Fire, explosion with fire, conflagration
76*	Hot liquids or steam (includes molten metals)
77*	Corrosive substances, external chemical burns only
78*	Sot solids or other hot objects
80*-89*	Specified environmental factors (natural or artificial environment)

Table A-1.—Continued

Code Groups	Category Descriptions
80*	Excessive heat or insulation
81*	Excessive cold
82*	High or low pressure
83*	Excessive noise
84*	Hunger, thirst, or exposure
85*	Lightning or cataclysm (includes tornado, flood, etc.)
86*	Drowning or submersion, nec
87*	Motion: travel (includes air sickness, etc.)
88*	Animals, nec
90*-99*	Falls and miscellaneous other unspecified agents
90*	Fall on or jump from stairs or ladder
91*	Other fall or jump from one level to another
92*	Falls/jumps on same level including unspecified
93*	Marching or drilling, not elsewhere classified
94*	Twisting, turning, slipping, running, etc., nec without fall
95*	Lifting, pushing, pulling
96*	Hanging, suffocation, or strangulation

Table A-1.—Continued

Code Groups	Category Descriptions
97*	Fighting, nec
98*	Other specified agents
99*	Unspecified causative agents, unknown

*	Place of Occurrence of Injury
0	On board aircraft or spacecraft in air or space.
1	On board ship, other water transport or in water, e.g., seas, rivers, lakes, etc.
2	On land and at an airfield.
3	On land and at a dock.
4	On land and at an industrial plant, e.g., ordnance factory, supply warehouse, repair shop, etc.
5	On land and on firing range or drill field.
6	On land and on obstacle course.
7	On land and in kitchen (other than home), mess hall, or bakery.
8	On land in the home, quarters, or barracks.
9	On land other or unspecified.

Table A-2. Veterans Administration Schedule for Rating Disabilities (VASRD) Codes

VASRD Codes*	VASRD Titles
5000-5300	Musculoskeletal (Orthopedic)
6000-6200	Visual/Auditory
6300-6800	Systemic/Respiratory
7000-7100	Cardiovascular
7200-7300	Digestive
7500-7600	Genitourinary/Gynecological
7700-7900	Blood/Skin/Endocrine
8000-8900	Neurological/Convulsive
9200-9500	Mental Disorders

* Codes as defined in 38 CFR 4.

Table A-3. Principal Diagnosis Groups and Their Corresponding ICD-9 Codes*

ICD-9 Codes	Principal Diagnosis Group Titles	Abbreviated Titles
001-139	Infectious and Parasitic Diseases	Infectious & Parasitic
140-239	Neoplasms	Neoplasms
240-279	Endocrine, Nutritional, and Metabolic Diseases and Immunity Disorders	Endocrine, Nutritional, & Metabolic
280-289	Diseases of the Blood and Blood Forming Organs	Blood & Blood Forming Organs
290-319	Mental Disorders	Mental Disorders
320-389	Diseases of the Nervous System and Sense Organs	Nervous System
390-459	Diseases of the Circulatory System	Circulatory System
460-519	Diseases of the Respiratory System	Respiratory System
520-579	Diseases of the Digestive System	Digestive System
580-629	Diseases of the Genitourinary System	Genitourinary System
630-676	Complications of Pregnancy, Childbirth, and the Puerperium	Pregnancy
680-709	Diseases of the Skin and Subcutaneous Tissue	Skin Diseases
710-739	Diseases of the Musculoskeletal System and Connective Tissue*	Musculoskeletal System
740-759	Congenital Anomalies	Congenital Anomalies
760-779	Certain Conditions Originating in the Perinatal Period	Perinatal Period Conditions

Table A-3.—Continued

ICD-9 Codes	Principal Diagnosis Group Titles	Abbreviated Titles
780-799	Symptoms, Signs, and Ill-Defined Conditions	Ill-Defined Conditions
800-999	Injury and Poisoning*	Injury
V01-V82	Supplementary Classification of Factors Influencing Health Status and Contact with Health Services	V Codes
E800-E999	Supplementary Classification of External Causes of Injury and Poisoning	E Codes

* Acute injury and injury-related conditions are generally coded within the Injury (800-999) and the Musculoskeletal System (710-739) principal diagnosis groups, respectively.

Table A-4. Major Diagnostic Categories Used by the Navy and Marine Corps*

Major Diagnostic Categories		Abbreviated Titles
MDC 1: Diseases and Disorders of the Nervous System		Nervous System
MDC 2: Diseases and Disorders of the Eye		Eye
MDC 3: Diseases and Disorders of the Ear, Nose, Mouth, and Throat		Ear, Nose, Mouth, & Throat
MDC 4: Diseases and Disorders of the Respiratory System		Respiratory System
MDC 5: Diseases and Disorders of the Circulatory System		Circulatory System
MDC 6: Diseases and Disorders of the Digestive System		Digestive System
MDC 7: Diseases and Disorders of the Hepatobiliary System and Pancreas		Liver & Pancreas
MDC 8: Diseases and Disorders of the Musculoskeletal System and Connective Tissue*		Musculoskeletal System
MDC 9: Diseases and Disorders of the Skin, Subcutaneous Tissue and Breast		Skin & Breast
MDC 10: Endocrine, Nutritional and Metabolic Diseases and Disorders		Endocrine, Nutritional, & Metabolic
MDC 11: Diseases and Disorders of the Kidney and Urinary Tract		Kidney & Urinary
MDC 12: Diseases and Disorders of the Male Reproductive System		Male Reproductive System
MDC 13: Diseases and Disorders of the Female Reproductive System		Female Reproductive System
MDC 14: Pregnancy, Childbirth, and the Puerperium		Pregnancy
MDC 15: Newborns and Other Neonates with Conditions Originating in the Perinatal Period		Newborns

Table A-4.—Continued

Major Diagnostic Categories	Abbreviated Titles
MDC 16: Diseases and Disorders of the Blood & Blood Forming Organs and Immunological Disorders	Blood & Immunology
MDC 17: Myeloproliferative Diseases and Disorders and Poorly Differentiated Neoplasms	Neoplasms
MDC 18: Infectious and Parasitic Diseases	Infectious & Parasitic
MDC 19: Mental Diseases and Disorders	Mental Disorders
MDC 20: Alcohol/Drug Use and Alcohol/Drug Induced Organic Mental Disorders	Alcohol & Drugs
MDC 21: Injury, Poisoning, and Toxic Effects of Drugs*	Injury
MDC 22: Burns*	Burns
MDC 23: Factors Influencing Health Status and Other Contacts with Health Services	Health Status
MDC 24: Multiple Significant Trauma*	Trauma
MDC 25: Human Immunodeficiency Virus Infections	HIV

* Acute injury and injury-related conditions are generally coded within major diagnostic categories 8, 21, 22, and 24. One-to-one comparisons between major diagnostic categories and principal diagnosis groups are, therefore, not possible (see Table 5-20).

APPENDIX B

GLOSSARY OF ACRONYMS

ACIPS	Army Casualty Information Processing System
ACMP	Automated Casualty Monitoring Program
ADS	Ambulatory Data System
AFB	Air Force Base
AFMIS	U.S. Air Force Mishap Information System
AFMSA	Air Force Medical Support Agency
AFSA	Air Force Safety Agency
AR	Army Regulation
ASIS	Abbreviate Severity of Injury Scale
ASMIS	Army Safety Management Information System
BIA	Brain Injury Association
BUD/S	basic underwater demolition/SEALS
CAIS	Casualty Assistance Information System (Marine Corps)
CCEP	Comprehensive Clinical Evaluation Program
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CHAMPUS	Civilian Health and Medical Program of the Uniformed Services
CY	calendar year, 1 January to 31 December
DA PAM	Department of the Army Pamphlet
DHHS	Department of Health and Human Services

DIOR	Directorate for Information Operations and Reports
DMDC	Defense Manpower Data Center
DMED	Defense Medical Epidemiology Database
DOB	date of birth
DoD	Department of Defense
DoDI	Department of Defense Instruction
DRG	diagnosis related group
DTIC	Defense Technical Information Center
DVA	Department of Veterans Affairs
DVHIP	Defense and Veterans Head Injury Program
FY	fiscal year, 1 October to 31 September
GMIS	Ground Mishap Information System
GOV	government owned vehicle
HQ	headquarters
HRA	health risk appraisal
ICD	International Classification of Disease
ICE	International Collaborative Effort on Injury Statistics
IPDS	Individual Patient Data System
LOC	loss of consciousness
MAD	median absolute deviation
MBDS	minimum basic data set
MCO	Marine Corps Order

MEB	Medical Evaluation Board
MILPERSMAN	Naval Personnel Manual
MOS	military occupational specialty
NATO	North Atlantic Treaty Organization
NAVMED	Naval Medicine
NERs	non-effective rates
NHRC	Naval Health Research Center
NIOSH	National Institute for Occupational Safety and Health
NMIMC	Naval Medical Information Management Center
OPHSA	Office for Prevention and Health Services Assessment
OPNAVNOTE	Chief of Naval Operations Note
PAB	parachute ankle brace
PASBA	Patient Administration Systems and Biostatistics Activity
PDCAPS	Physical Disability Case Processing System
PDS	Personnel Data System
PEB	Physical Evaluation Board
PETS	Physical Evaluation Tracking System
POV	privately owned vehicle
R&D	research and development
RCMAS	Retrospective Case Mix Analysis System
SADR	Standard Ambulatory Data Record
SE	standard error
SECNAVINST	Secretary of the Navy Instruction
SF	Standard Form
SIDR	Standard Inpatient Data Record

SIMS	Safety Information Management System
SSN	Social Security Number
STANAG	Standardization Agreement
TAIHOD	Total Army Injury and Health Outcomes Database
TBI	traumatic brain (head) injury
TDRL	Temporary Disability Retired List
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAF	U.S. Air Force
USAMRMC	U.S. Army Medical Research and Materiel Command
USARIEM	U.S. Army Research Institute of Environmental Medicine
VA	Veterans Administration
VASRD	Veterans Administration Schedule for Rating Disabilities
WCS	Worldwide Casualty System
WHS	Washington Headquarters Services
WRAMC	Walter Reed Army Medical Center

APPENDIX C

GLOSSARY OF TERMS

The definitions used herein apply solely to this atlas and may vary from definitions established in Joint Pub 1-02, Department of Defense Dictionary of Military and Associated Terms. Agencies that collect and/or report data presented in this atlas may use different operational definitions of the same terms. When necessary, more than one definition is provided so that the reader can consider the subtle differences inherent in some of these instances.

accident

An unplanned event or series of events resulting in death, injury, occupational illness, or damage to or loss of equipment or property, or damage to the environment. Although the military services still use this term, the public health community strongly recommends against the use of this term in favor of "unintentional event" or "mishap."

active duty

Full-time duty in the active military services of the United States. It is a general term applied to all active military service with the active force without regard to duration or purpose. Note: The definition of active duty chosen can greatly confound rates of injury and disease as reported by various DoD agencies since the ability to accurately determine the status affects both numerator and denominator calculations. For example, active duty service members of any service and those on active duty with the National Guard or Reserves have identical health benefits. It may, therefore, be difficult to distinguish the active duty National Guard or Reserve service member from other active duty, and the result is that there are too many cases counted in the numerator.

armed forces of the United States

Includes the Army, Navy, Air Force, and Marine Corps.

aviation accident

Accidents that involve flight or are flight related (aircraft engine is running).

basic training

Entry-level military training required of all individuals who desire to enter the military services. Length of training varies by military service from 6 to 12 weeks. Synonymous with basic combat training.

battle casualty

Any casualty incurred as the direct result of hostile action sustained in combat or sustained going to or from a combat mission. Included are persons killed or wounded accidentally by friendly fire directed at a hostile force or what was thought to be a hostile force. However, the following injuries are *not* battle casualties: (1) self-inflicted wounds (except in unusual cases); and (2) wounds or death inflicted by a friendly force while the soldier is absent without leave, dropped from the rolls, or is a voluntary absentee from his or her place of duty.

bed day

- a. A day in which a patient occupies an authorized operating bed (clinic beds are not authorized operating beds) at the census-taking hour, normally midnight. As of early 1997, a patient admitted and discharged (final disposition) on the same day is no longer assigned a bed day. The following are occupied bed days:
 - Days on pass or liberty from the hospital or clinic not in excess of 72 hours.
 - Days a newborn infant occupies a bassinets.
 - Days in the labor or delivery room (see "b" below).

- b. When the patient occupies a bed in more than one inpatient care area in one day. The occupied bed day is counted only in the inpatient care area where the patient is located at the census-taking hour. (This definition excludes days when the inpatient is subsisting out, on convalescent leave, on authorized or unauthorized leave, on pass in excess of 72 hours, in a transient status, and so on. It does not apply to boarders.) Military patients may be assigned a bed that is not an operating bed. In this case, days accumulated will be sick days rather than occupied bed days.
- c. Days accumulated from the date of admission to the date of final disposition (length of patient stay) provided the conditions in "a" above apply.

Beirut barracks explosion

In 1983, 241 U.S. Marines died when a terrorist truck-bomb crashed into their Beirut barracks.

cause of injury

See E code and external cause of injury.

casualty

Synonymous with death and fatality.

Class A accident/mishap

Fatality or permanent total disability; \$1M or more, and/or aircraft, missile, or spacecraft destroyed.

Class B accident/mishap

Permanent partial disability, or five or more people are hospitalized as inpatients; \$200K or more, but less than \$1M.

Class C accident/mishap

Nonfatal injury resulting in loss of time from work beyond day/shift when injury occurred, *or* nonfatal illness or disability resulting in loss of time from work or disability at any time (lost time case); \$10K or more, but less than \$200K. Note: The Navy defines a Class C mishap as requiring 5 days of lost duty.

combat soldiering

Using/developing skills peculiar to combat, including receiving instruction or training in such skills. Excludes classroom training (e.g., hand-to-hand combat, slide for life, rope bridge, bayonet training, military operations on urban terrain).

confidence interval

An interval of values with a defined probability of containing the population mean (or other numerical value being estimated). The probability most commonly used is a 95% confidence interval (e.g., see Chapter 8), but occasionally a 90% confidence interval is also given.

cumulative incidence rate

The number or proportion of a group of people who experience the onset of a health-related event during a specified time interval.

cumulative incidence rate ratio

The ratio of the cumulative incidence rate in the exposed to the cumulative incidence rate in the unexposed.

death rate

The number of deaths in a population at risk over a specified period of time. The crude death rate is the ratio of the number of deaths in a geographic area in one year divided by the average or midyear population in the area during the year.

denominator

The lower portion of a fraction used to calculate a rate or a ratio.

diagnosis

A patient's condition as determined by the health care provider and as coded in the patient's medical record using the ICD-9 Clinical Modification (CM), or a more recent version (ICD-10 is expected to be fully implemented in the U.S. by 2001). In the Standard Inpatient Data Record (SIDR), each record may contain up to eight diagnostic codes. The principal diagnosis is listed first, followed by any secondary diagnoses. The principal diagnosis by definition is the condition established, after study, to be chiefly responsible for the hospital admission. It is not necessarily the most serious diagnosis, nor is it always the patient's chief complaint on admission.

diagnosis related group

A complex, comprehensive system of grouping ICD-9-CM diagnosis and procedure codes comprising 495 separate classifications, each based on average hospital resource consumption and length of stay patterns.

disability

Temporary or long-term reduction of a person's capacity to function in society, remain in military service, or perform work of office grade rank or rating.

disease

A condition in which the physical and/or mental health is impaired due to a process other than that caused by injury, accident, violence, or poisoning. Synonymous with illness. (A detailed listing of disease may be found in Volume I, International Classification of Diseases, Adapted for Use in the United States (ICD-9-CM) Ninth Revision, diagnostic codes 001 to 999.)

disposition

The status of a patient upon discharge from a medical center or hospital (e.g., returned to duty, on limited duty, transferred to another medical treatment facility, etc.).

distribution

The complete summary of the frequencies of the values or categories of a measurement made on a group of persons. The distribution tells either how many or what proportion of the group was found to have each value (or each range of values) out of all the possible values that the quantitative measure can have.

dynamic lift test

The incremental dynamic lift is a measure of lifting ability that uses a one repetition maximum lifting procedure. Subjects lift stacked weights attached to handles. The weight stack is lifted vertically from 20 cm to 152 cm, simulating the task of lifting a box with handles from the ground to the back of a 2.5 ton truck. The initial weight lifted is 18.2 kg; this is increased until the subject is unable or unwilling to complete the lift using a safe technique. This has been used in a number of military investigations to determine lifting ability.

E code

See external cause of injury.

external cause of injury

A code used in addition to, and to provide additional detail to certain, ICD-9 codes with the range 800-999, which classifies the environmental events, circumstances, and conditions leading to an injury, poisoning, or other condition. With rare exception, ICD-9 E codes are not used by DoD hospitals; STANAG codes are used instead.

fatality

Death. See casualty.

fiscal year

For the Department of Defense and the military services, the fiscal year is 1 October through 30 September of the following year.

fit for duty

Medical condition does not interfere with reasonable performance of duties of office, grade rank, or rating.

Gander, Newfoundland, crash

An Arrow Air DC-8 crashed at Gander, Newfoundland, in December 1985 killing 248 U.S. Army soldiers and the crew of eight.

Glasgow Coma Scale

A scale used to classify of the severity of a severe head injury (see scale on page 7-12).

government motor vehicle

A motor vehicle that is owned, leased, or rented by a DoD component (not individuals); primarily designed for over-the-road operations, but also includes tracked vehicles; and whose general purpose is the transportation of cargo or personnel. Examples of government motor vehicles are passenger cars, station wagons, ambulances, buses, motorcycles, trucks, and tractor-trailers.

ground accidents

Any "accident" on the ground exclusive of aviation (flight or flight-related), fire (ashore), private motor vehicle, government motor vehicle, missiles, nuclear, and explosive mishaps. For Navy, ship and/or submarine and/or diving mishaps are excluded.

Gulf War

The Gulf War was fought in early 1991 between Iraq and a coalition of 39 countries organized mainly by the United States and the United Nations. The coalition formed after Iraq invaded Kuwait on 2 August 1990. On 17 January 1991, the coalition began bombing Iraqi military and industrial targets. In late February, the coalition launched a massive ground attack into Kuwait and southern Iraq and quickly defeated the Iraqis. Coalition military operations ended on 28 February. A total of 199 Army soldiers died during the Gulf War.

hostile, hostile conditions, or hostile actions

See battle casualty.

human movement

Walking, running, getting in or out of a vehicle, or some type of movement that is not related to another task (e.g., vehicle accident or weapons handling).

illness

An interruption, cessation, or disorder of body functions, systems, or organs. Synonymous with disease.

A morbid entity characterized usually by at least two of these criteria: recognized etiologic agent(s), identifiable group of signs and symptoms, or consistent anatomical alterations.

infantry initial entry training

Twelve-week basic combat training that is specific to the Army infantry occupational specialty.

injury

In general, any intentional or unintentional damage to the body resulting from acute exposure to thermal, mechanical, electrical, or chemical energy or from the absence of such essentials as heat or oxygen.

- Specific to Chapter 3 of the atlas, a traumatic wound or other condition of the body caused by external force, including stress or strain. The injury is (1) identifiable as to time and place of occurrence and member or function of the body affected, and (2) caused by a specific event or incident or series of events or incidents within a single day or work shift.
- Specific to Chapter 6 of the atlas, dermatologic or musculoskeletal damage resulting from an external force of repetitive or traumatic nature.

intentional injury

Dermatologic or musculoskeletal damage resulting from an external force of repetitive or traumatic nature which is caused by a planned, but often preventable, event (e.g., suicide and homicide).

International Classification of Disease

The classification of specific conditions and groups of conditions determined by an internationally representative group of experts who advise the World Health Organization, which publishes the complete list in a periodically revised book, the (Manual of the) International Statistical Classification of Diseases, Injuries and Causes of Death. This system was originally developed for coding cause of death. Recent versions have been adapted (modified) to provide morbidity coding useful in the hospital or outpatient setting. The current version—ICD-9-CM—is being replaced by ICD-10.

Iraqi missile attack on USS Stark

While on patrol in the Persian Gulf on 17 May 1987, 37 sailors died when the guided-missile frigate was struck by two Iraqi missiles.

limited duty

A variation in normal job tasks due to a physical limitation.

load carriage task

A technique used to measure muscle strength and endurance where the study subject is asked to carry an 18.2 kg (40 lb) metal box along a 91.4 m (100 yd) course as quickly as possible. The time taken to complete this task is recorded and converted to velocity in meters per second.

logistic regression

A type of regression analysis in which the dependent variable (y) is dichotomous.

lost duty day

A day in which a physical limitation is prescribed to a patient by a medical care provider or in which a patient is hospitalized.

lost time case

Nonfatal traumatic injury that causes loss of time from work beyond the day/shift on which it occurred, or nonfatal nontraumatic illness that causes loss of time from work or disability at any time.

major diagnostic category

A system for grouping ICD-9-CM codes based on anatomical characteristics or clinical care required. This categorization contains 25 subgroups and differs from the standard ICD-9-CM principal diagnosis groups (PDGs) which contain only 17 subgroups. Various DoD agencies may use either system of reporting hospital outcomes, making direct comparisons between them impossible. For example, within the MDC system, injury-related hospitalizations may be found within MDC 8 (diseases and disorders of the musculoskeletal system and connective tissue), MDC 21 (injury, poisonings, and toxic effects of drugs), MDC 22 (burns), and MDC 24 (major significant trauma). Within the ICD-9-CM PDGs, they are likely to be found only in PDG 13 (diseases of the musculoskeletal system and connective tissue, and PDG 17 (injury and poisoning). See Appendix A, Table A-4, for complete MDC listing.

mechanism of accident/event

The agent or means by which an injury event occurred (e.g., acid burn, explosion, fall from height, sports, etc.).

medical evaluation board

A board convened to document a soldier's medical status and duty limitations insofar as duty is affected by the soldier's status. A medical evaluation board precedes a physical evaluation board.

military personnel

Includes all military personnel on active duty, and National Guard or Reserve personnel on active duty or in drill status.

military services

Refers to the Army, Navy, Air Force, and Marine Corps. In time of war, the Coast Guard falls under the Navy.

minimum basic data set

A group of general case indicators (variables) that has been determined to be necessary to effectively follow injury trends and describe and detail circumstances of an injury event. This data is used to identify "hot spots" and set policy.

mishap

Unplanned event or series of events that causes injury or occupational illness (excludes intentional/violent injuries resulting from hostile actions, homicides, and suicides, as well as nonoccupational diseases).

mishaps, nonoperational

The Navy defines nonoperational mishaps as those which are not Navy operational mishaps. These consist of (1) cases in which Navy military personnel or any military personnel assigned to the Navy are injured while using Navy-owned and maintained service-related facilities, such as pools, athletic fields, retail stores, clubs, child centers, and housing; (2) cases in which any person (military, federal civilian, non-DoD) is injured due to negligence in the maintenance of Navy-owned and maintained service-related facilities; and (3) cases in which off-duty Navy military personnel or military personnel assigned to the Navy are injured in any other capacity not previously mentioned and not considered as operational.

mishaps, operational

The Navy defines operational mishaps as those in which DoD or non-DoD property is damaged or any person (military, federal civilian, non-DoD) is injured as a direct result of the execution of specific Navy operations.

morbidity rate

The number of sick or injured persons in a population at risk over a specified period of time.

mortality rate

The number of deaths in a population at risk over a specified period of time. The crude death rate is the ratio of the number of deaths in a geographic area in one year divided by the average or midyear population in the area during the year.

musculoskeletal

Pertaining to or comprising the skeleton and the muscles, as musculoskeletal system.

nonbattle injury

A traumatic injury due to causes other than combat, including acute poisoning (except food poisoning) and exposure to heat, cold, and light.

noncombat soldiering

Noncombat activities peculiar to military life, including receiving instruction/training in such activities. Excludes classroom training (e.g., marching, police call, formation, barracks detail, field sanitation).

non-effective days

Number of days on the hospital rolls, in a hospital bed, or on convalescent leave.

non-effective rate

A point prevalence ratio derived from the number of men not present for full duty for medical reasons, in relation to 1,000 men assigned to the unit per day. The numerator includes not only those admitted to the hospital but also those present for duty who were previously hospitalized and for related medical reasons cannot fully perform their assigned duties.

nonfatal injury

Injury resulting in loss of time from work beyond the day or shift when injury occurred.

nonfatal illness or disability

Illness or disability resulting in loss of time from work or disability at any time (lost time case).

numerator

The upper portion of a fraction used to calculate a rate or a ratio.

occupational illness

Nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness is any reported condition that does not meet the definition of injury and that is related to occupation.

odds ratio

The ratio of the odds of injury or disease among the exposed to the odds of injury or disease among the unexposed. A surrogate for a risk ratio. It is used when a rate cannot be calculated directly.

off duty

When DoD personnel:

- Are not in an on-duty status, whether on or off DoD installations ashore.
- Have departed official duty station, temporary duty station, or ship at termination of normal work schedule.
- Are on leave and/or liberty.
- Are traveling before and after official duties, such as driving to and from work.
- Are participating in voluntary base and/or installation team sports.
- Are on permissive temporary duty (at no cost to the government other than pay).
- Are on lunch or other rest break engaged in activities unrelated to eating or resting.

"Off duty" is not related to "line of duty," which pertains to the legal evaluation of a service member's personal responsibilities for his/her injuries.

on duty

Where DoD personnel are:

- Physically present at any location (area under the control of a DoD component) where they are to perform their officially assigned work. (This includes those activities incident to normal work activities that occur on DoD installations, such as lunch, coffee, or rest breaks, and all activities aboard vessels.)
- Being transported by DoD or commercial conveyance for the purpose of performing officially assigned work. (This includes reimbursable travel in private motor vehicles for performing temporary duty, but not routine travel to and from work.)
- Participating in compulsory physical training activities (including compulsory sports).

operations

The Navy defines operations as official, authorized activities conducted or provided by Navy-owned and maintained facilities. Facilities include aircraft, surface ships, submarines, government motor vehicles, and shore establishments including service-related facilities.

Operations Desert Shield and Storm

That period of time starting with the first deployment of U.S. forces to the Persian Gulf up to but not including the first irretrievable exchange of hostile fire (Desert Shield) followed by massive air strikes and a ground attack (Desert Storm). Desert Storm was said to have ended when the last U.S. soldiers present during the conflict returned home. See also Gulf War.

overuse injury

Tissue damage resulting from repetitive, cumulative microtrauma (e.g., tendinitis, stress fractures, patellofemoral syndrome).

pending

The terms applies to nonhostile casualties. The term is used whenever an initial or interim report is issued while awaiting the results of an investigation, toxicological examination, or autopsy, such as in an apparent self-inflicted death. "Pending" represents a transitory classification.

permanent disability

A disability disposition characterized by the following: (1) the service member is unfit by virtue of a permanent and stable compensable physical disability, and (2) has at least 20 years service *or* minimum disability rating of 30 percent under the VASRD. The individual receives payments for the rest of his/her life.

permanent limited duty

The continuation on active duty or in the Ready Reserve in a limited duty capacity of a service member determined unfit as a result of a physical disability evaluation or medical disqualification.

permanent partial disability

An injury or occupational illness that does not result in death or permanent total disability but, in the opinion of the competent medical authority, results in permanent impairment through loss or loss of use of any part of the body, with the following exceptions: loss of teeth; loss of fingernails or toenails; loss of tips of fingers or tips of toes; inguinal hernia, if it is repaired; disfigurement; and sprains or strains that do not cause permanent limitation of motion.

permanent total disability

Any nonfatal injury or occupational illness that, in the opinion of competent medical authority, permanently and totally incapacitates a person to the extent that he or she cannot follow any gainful occupation. Note: The loss, or the loss of use, of both hands, both feet, both eyes, or a combination of any of these body parts as a result of a single accident/mishap is considered a permanent total disability.

personnel injury

Injury to personnel as a result of operations or an injury to off-duty military personnel which cannot be classified as any other accident type.

physical evaluation board

Fact-finding board established to evaluate all cases of physical disability equitably for the soldier. The physical evaluation board (PEB) makes recommendations for fitness for duty, disability discharge from service, and percent disability. PEBs are convened after medical evaluation boards.

physically unfit

Unfitness due to physical disability. The unfitness is of such a degree that a soldier is unable to perform the duties of the office grade, rank or rating in such a way as to reasonably fulfill the purpose of employment on active duty. "Physically unfit" is synonymous with "unfit because of physical disability."

Pope Air Force Base incident

On 23 March 1994, a disabled Air Force F-16 crashed at Pope Air Force Base, North Carolina, resulting in 11 deaths and 130 injuries among Army paratroopers on the ground.

principal diagnosis group

A system of grouping diagnoses under the International Classification of Diseases that is comprised of 17 general categories, and two supplemental categories. The 17 general categories, simply described, include infectious disease, cancer, endocrine, blood, psychiatric, neurological, circulatory, respiratory, digestive, genitourinary, pregnancy, skin, musculoskeletal, congenital, perinatal, symptoms, and injury. The two supplemental groups are for cause of injury (E-codes), and for factors influencing health status and contact with health services (V-codes). (See also definition of major diagnostic category). See Appendix A, Table A-3, for complete listing.

private motor vehicle mishap

A traffic mishap regardless of the identity of the operator, that does not involve a government motor vehicle, but results in a fatality or lost time case injury (involving days away from work) to military personnel on or off duty or to on-duty civilian personnel, or reportable damage to DoD property.

quartiles

Divisions of a distribution into four equal, ordered subgroups; the first quartile represents the first 25 percent of the distribution, the second quartile represents the next 25 percent of the distribution, etc.

rate

An expression of the frequency with which an event occurs in a defined population. The use of rates rather than raw numbers is essential for the comparison of events between populations, at different times, different places, or among different demographic subgroups.

rate ratio

The ratio of an injury or illness rate in the exposed population to the rate in the unexposed population.

regression analysis

Given data on a dependent variable (y) and one or more independent variables (x_1, x_2 , etc.). Regression analysis involves finding the "best" mathematical model (within some restricted class of models) to describe y as a function of the x 's, or to predict y from the x 's. The most common form is a linear model; in epidemiology, the logistic and proportional hazards models are also common.

repetitive loading

Overuse such as marching or running.

risk factors

An aspect of personal behavior or lifestyle, an environmental exposure, or an inborn or inherited characteristic which, on the basis of epidemiologic evidence, is known to be associated with health-related condition(s) considered important to prevent. Examples of injury risk factors include low fitness, older age, prior injury, etc.

separation

An all-inclusive term that is applied to personnel actions resulting from release from active duty, discharge, retirement, dismissal, resignation, dropped from the rolls, or death. In this Atlas, separation means discharge because of physical disability with or without severance pay.

separation with no benefits

A disability disposition characterized by one or both of the following: (1) service member is unfit by virtue of a disability incurred as a result of intentional misconduct, willful neglect, or during unauthorized absence; or (2) the disability existed prior to service and was not permanently aggravated by service.

separation with severance pay

A disability disposition characterized by the following: (1) service member is unfit by virtue of physical disability; (2) service member has less than 20 years of service; (3) and the disability is rated at 0-30 percent under the VASRD. The stability of the medical condition is not a factor for this disposition and the total lifetime disability compensation cost is represented by a one-time separate payment.

shore/recreational

All recreational mishaps plus all off-duty shore mishaps that are not motor vehicle accidents.

shore operational

Operational mishaps that are not aviation, afloat, or government motor vehicle related.

sick call visit

An outpatient clinic visit for a non-urgent medical condition such as a cold, the flu, or a minor injury such as a sprain or strain.

special purpose vehicle

An army vehicle other than an aircraft, tracked vehicles, and wheeled vehicles (e.g., aircraft tugs, bulldozers, forklifts, trains, and similar vehicles).

standardization agreement (STANAG) code 2050

The NATO standardization agreement entitled "Statistical Classification of Diseases, Injuries, and Causes of Death." This agreement, first ratified by the United States in the 1950s, underwent its last major revision (Edition 5) in 1989. The agreement is published by the Military Agency for Standardization (MAS) housed at NATO headquarters, Brussels. STANAG 2050 is a list of codes used by all U.S. Department of Defense hospitals to categorize injury cause. This system is analogous to the ICD-9-CM based E-code system but is somewhat simplified. The main difference between the two is that the STANAG includes more specific codes for both combat-related injuries and sports injuries. STANAG 2050 uses 4 digits to code cause of injury. The first digit relates to intent and duty status, the second and third digits relate to specific causes, and the fourth digit relates to location. (See also E-code and external cause of injury.)

stress fracture

Any bone injury due to repetitive loading (overuse such as marching or running).

surveillance

Ongoing monitoring and analysis used to detect changes in trends or distributions so that investigative or control measures may be initiated.

temporary disability

A disability disposition characterized by the following: (1) the service member's medical condition is not stable (VASRD rating could change over time); (2) 0-100 percent disability under the VASRD with over 20 years of service or 30-100 percent disability under the VASRD with less than 20 years of service. A temporary disability is reevaluated every 18 months, at a minimum, and the individual can be on temporary disability retirement no more than 5 years.

temporary disability retired list

The TDRL is used in the nature of a "pending list." It provides a safeguard for the government against permanently retiring a soldier who can later fully recover, or nearly recover, from the disability causing him/her to be unfit. Conversely, the TDRL safeguards the soldier from being permanently retired with a condition that may reasonably be expected to develop into a more serious permanent disability.

tracked military vehicle

Army combat vehicles or combat equipment, such as a tank, self-propelled weapon, armored personnel carrier, or amphibious vehicle ashore.

traumatic injury

Tissue damage resulting from sudden, overload trauma (e.g., sprains, fractures, contusions, dislocations, lacerations).

unintentional injury

Dermatologic or musculoskeletal damage resulting from an external force of repetitive or traumatic nature which is caused by an unplanned, but often preventable, event. Excludes intentional/violent injuries resulting from hostile actions, homicides, and suicides, as well as nonoccupational diseases.

V code

A supplementary section of the ICD-9-CM used for classification of factors influencing health status and contact with health services (V01-V82). This classification is used to code occasions when circumstances other than disease or injury (and therefore not covered by ICD-9-CM codes 001-999) result in contact with the health care system. This can arise in several ways including blood or organ donation, to receive vaccinations, when a person with a previously diagnosed condition receives care only for a specific treatment (e.g. chemotherapy, hemodialysis), or when a problem is present which influences health status but is not in and of itself a current injury or illness (e.g., pregnancy, history of alcoholism, allergies, etc).

violent injury

An intentional action of another person or towards oneself (e.g., homicide or suicide).

visit

Occurs each time an eligible beneficiary (either inpatient or outpatient) presents himself or herself to a separate, organized clinic or specialty service for examination, diagnosis, treatment, evaluation, consultation, counseling, or medical advice. A signed and dated entry is made in the patient's inpatient treatment record, outpatient treatment record, health record, or other record of medical treatment. Multiple visits occur when the patient is referred from one care provider to another for consultation or is seen in different clinics or in the same clinic for different complaints.

wheeled military vehicle

A vehicle owned, leased, or rented by the Department of the Army (not an individual), to include Reserve components. The vehicle is primarily designed for over-the-road operation and its general purpose is the transportation of cargo or personnel (e.g., passenger cars, station wagons, trucks, ambulances, buses, motorcycles, fire trucks, and refueling vehicles).

APPENDIX D

REFERENCES

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